

# PUBLIC WORKS

*city  
county  
and state*

**october  
1949**



## Remember Jeffrey

WHEN YOU WANT THE LATEST IN  
EQUIPMENT FOR THE TREATMENT OF

## sewage • Water • Industrial Waste

Bar and Disc-type  
Screens  
Screenings Grinders  
Grit Collectors  
Grit Washers

Sludge Collectors  
Sludge Elevators  
Scum Removers  
FLOCTROLS  
Chemical Feeders

Garbage Grinders  
Belt and Spiral  
Conveyors  
Bucket Elevators  
Chains and Sprockets  
Transmission Machinery

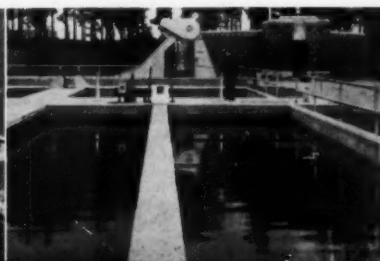
FACTORY ENGINEERING DIVISION

## THE JEFFREY MANUFACTURING CO.

947 North Fourth St., Columbus 16, Ohio

Chicago 1	Detroit 13	Jacksonville 2	Pittsburgh 22
Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
Cleveland 13	Houston 5	New York 7	Salt Lake City 1
Denver 2	Huntington 19	Philadelphia 3	Scranton 3

JEFFREY MFG. CO., LTD., Head Office and Works, MONTREAL



some of the articles  
in this issue:

Industrial Waste  
Data

Economy in Airport  
Design

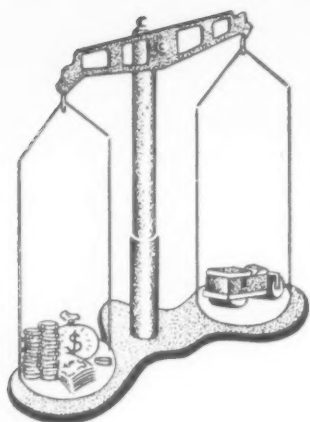
Prestressed Concrete  
Applications

Drilling the Deepest  
Water Well

Maintaining Roads  
by Contract

★ ★ ★

Complete Contents  
Listed on Page 5



*the Balance*  
**IS IN YOUR FAVOR**  
**WITH MODERN**



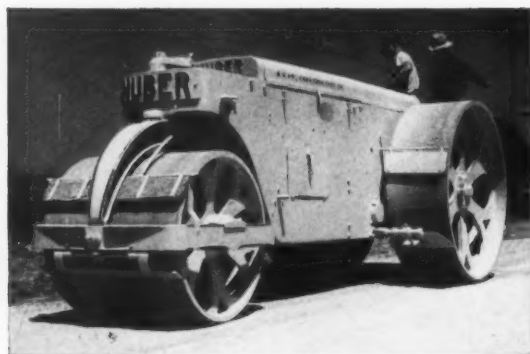
**ROAD MACHINERY**



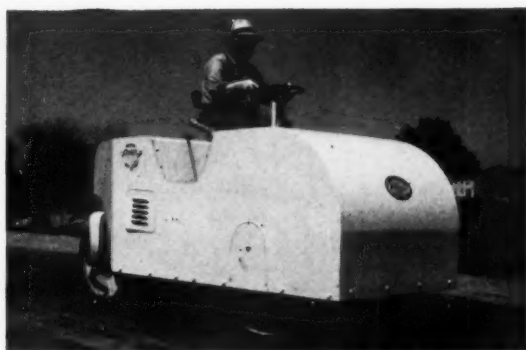
Huber's versatile Road Maintainer—a lift loader, berm leveler, bulldozer, patch roller, snow plow, or rotary broom all in one.

Today's conditions demand that your operation's budget balance out. Modern Huber road machinery will help you do better than that—the efficient, result-producing Huber line will actually tip the balance in your favor.

Road men, from maintenance crews to new road contractors recognize the "extras" that are built into every piece of Huber equipment. Plenty of power...economical operation...dependable performance...and the ability to do any job are Huber traits that point to more profitable road operations for you. Write today for bulletins on the Huber equipment that will best serve you.



Huber's always dependable 3-Wheel Rollers—built in sizes, from 5 to 12 tons, suited to any rolling operation.



Huber's highly maneuverable Tandem Rollers lend themselves to many special tasks. Variable weight models from 3 to 14 tons.



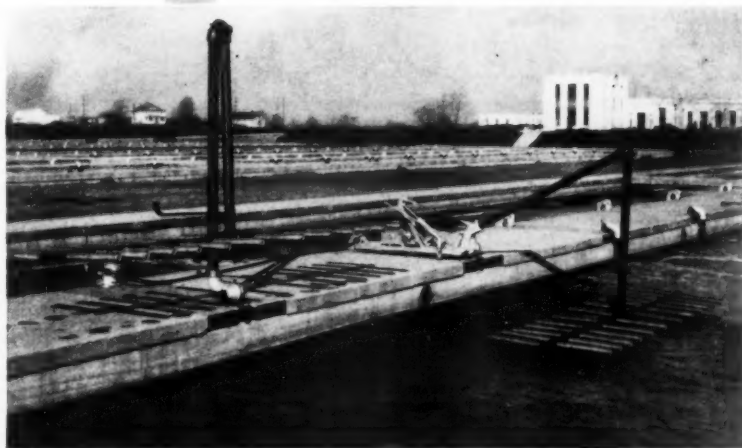
THE

MFG. COMPANY • MARION, OHIO, U. S. A.

**HUBER**

*3 Wheel • Tandem*  
**ROAD ROLLERS**  
*and*  
**MAINTAINERS**

Consulting and Design Engineers  
Consistently Specify  
*"Chicago"*  
**SWING DIFFUSERS**  
FOR MAXIMUM AERATION EFFECTIVENESS



Sewage Treatment Plant  
Columbus, Ohio  
Paul A. Uhlmann & Associates  
ENGINEERS

\*Replacement of existing plate system  
\*\*Extension of existing plate system

**SOME SWING DIFFUSER SYSTEMS  
RECENTLY SPECIFIED OR INSTALLED:**

Philadelphia, Pa.—Northeast Plant  
\*Columbus, Ohio  
Syracuse, N. Y.—Ley Creek Plant  
New York City—Owl's Head Plant  
New York City—Hunt's Point Plant  
\*Madison, Wis.  
Oklahoma City, Okla.—Northside Plant  
Nassau County, N. Y.  
Bergen County, N. J.  
\*Chicago Heights, Ill.  
Los Angeles, Calif.—Hyperion Plant  
\*Richmond, Ind.  
Boise, Idaho  
Boston, Mass.—Nut Island Plant

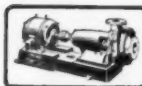
**SWING DIFFUSERS INSTALLED OR SPECIFIED IN OVER 200 OTHER PLANTS SINCE 1937**

A complete list of  
Swing Diffuser Systems  
with the names of the  
Engineers who designed  
them will be sent upon  
request

**CHICAGO PUMP COMPANY**  
**SEWAGE EQUIPMENT DIVISION**

2348 WOLFRAM STREET

Flush Kleen, Scrub-Peller, Plunger,  
Horizontal and Vertical Non-Clogs  
Water Seal Pumping Units, Samplers,



CHICAGO 18, ILLINOIS

Swing Diffusers, Stationary Diffusers,  
Mechanical Aerators, Combination  
Aerator-Clarifiers, Comminutors,

# A NEW ALL STAR CAST



**THE NEW  
TD-24**

The new TD-24 offers you more horsepower than any other crawler tractor available today—180 hp. at the flywheel, 140 hp. at the drawbar—plus dozens of features found only in the new TD-24.



The new TD-14A has 60 drawbar horsepower and many mechanical improvements. Here is power to produce bigger payloads and to cut earthmoving costs.



**THE NEW  
TD-18A**

Famous for its power and dependability, the new TD-18A now gives you 87 drawbar horsepower. All the famous International diesel engine features and the durable construction of the new International TD-18A make this tractor an even greater producer than ever before.

Your International Industrial Power Distributor is now ready to furnish you with three great new stars of earthmoving power and performance—the new TD-24, the new TD-18A and the new TD-14A.

The great new TD-24 is America's most powerful and versatile crawler tractor with unmatched features for easier operation and far greater production. No other crawler tractor can give you all the features found in the new International TD-24.

And the other two stars on the new International

earthmoving team are the TD-18A and TD-14A. Known for years for their dependable performance, these two efficient tractors have had their power increased to do more work, to operate with even greater ease and economy.

See your International Industrial Power Distributor now. Find out the facts and get these new tractors to work for you. You'll have an all star cast in your earthmoving line-up.

INTERNATIONAL HARVESTER COMPANY, Chicago, Ill.

**CRAWLER TRACTORS  
WHEEL TRACTORS  
DIESEL ENGINES  
POWER UNITS**



## INTERNATIONAL INDUSTRIAL POWER

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97

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310 East 45th St., New York 17, N. Y.

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# Public Works

THE ENGINEERING AUTHORITY  
IN THE CITY-COUNTY FIELD

Edited by

W. A. HARDENBERGH and A. PRESCOTT FOLWELL

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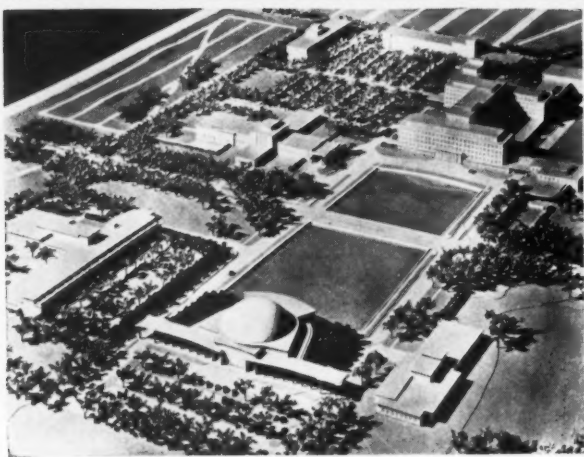
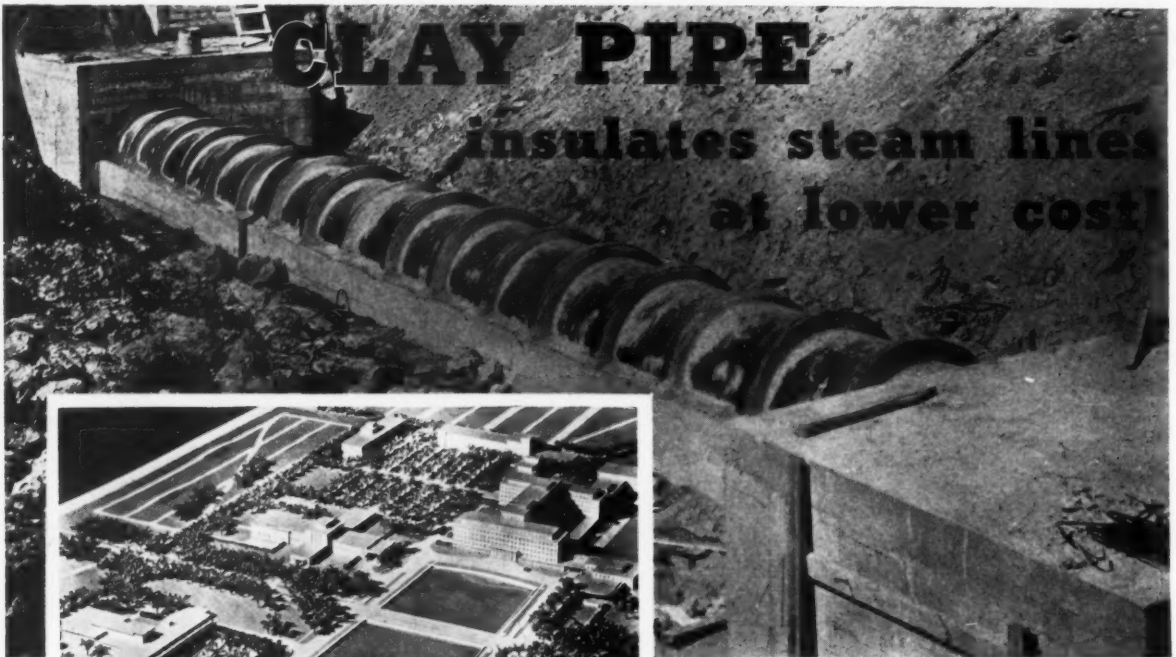
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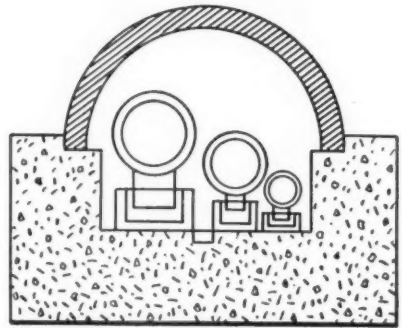
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*Voorhees, Walker, Foley and Smith, Architects and Engineers on The Ford Motor Company's new Research and Engineering Center at Dearborn, Michigan, specified 36" Vitrified Clay Channel Pipe for insulation of the 10" main steam distribution line, 6" pump discharge line, and the 2" trap discharge line running to the Center's half-dozen buildings. (See diagram below.)*

**E**NGINEERS of the Ford Motor Company knew what they were doing when they installed Clay Pipe in waste disposal lines of this huge, 50-million-dollar project. They also used Clay Channel Pipe for long-lasting, efficient insulation for the Center's more than 1,600 feet of underground steam lines! With a keen eye on speedy, easy construction at low cost, they knew they could build up their own steam line insulation with Clay Channel Pipe as the outside cover, and save time and money on the job. Why not get the facts from us and use the same construction on your job?



#### **NATIONAL CLAY PIPE MANUFACTURERS, INC.**

1105 Huntington Bank Bldg., Columbus 15, Ohio

703 Ninth & Hill Bldg., Los Angeles 15, Calif.

100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.

206 Connally Bldg., Atlanta 3, Ga.

*Vitrified*  
**CLAY PIPE**

C-949-3

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97

# THE EDITOR'S PAGE

## The High Cost of Labor and How to Overcome It

The high cost of labor these days requires the maximum use of modern equipment; and there seems to be no chance in the reasonably near future that this condition will change. For that reason, it is sound business to buy very good equipment and to maintain it properly. There is a special section in this magazine in which we try to describe all of the new devices and equipment desirable and suitable for this public works field; and we try to tell what the equipment can be used for and why it may be valuable to our readers. This usually requires reading through several pages of material describing the nuts, bolts, washers and other items of which the equipment is composed. Our own feeling is that equipment put out by a reputable concern is presumed to be good and we personally don't care whether it has 1/2-inch or 9/16-inch bolts holding it together.

Surprising savings can be made by reducing hand labor. A recent installation of a sludge filter employs a bucket elevator to raise the sludge from the sump to the conditioning tank; another bucket elevator to handle the lime mixture; and a belt conveyor to discharge the filtered sludge directly into a truck. One man operates the entire unit, and he has no difficult physical work to perform. As compared to the old way of handling the sludge, this extra equipment on this new filter will pay off, through labor saving costs, in probably two years.

Essentially the same condition exists in many other fields. It is up to the engineer, who is especially fitted by his training and experience for such work, to investigate these possibilities and to apply them whenever possible. We shall continue to publish articles telling how equipment can be used for faster and lower cost work; and we will welcome contributions from our readers telling of their experiences along these lines.

## Tropical Diseases in the Navy and Marine Corps

Information on the incidence of tropical diseases in Navy and Marine Corps personnel during World War II is now available, though not in complete form. Of particular interest is the fact that during the years 1942 to 1945, there were 113,744 cases of malaria, 37,663 cases of dengue, 19,996 cases of bacillary dysentery, and 20,686 cases of hepatitis. The Navy was notoriously lacking in sanitary engineering and allied skills and in the ability to use them; and took late and halting advantage of resources in these fields supplied by the Army Sanitary Corps. The control of malaria, dengue and dysentery is largely an engineering problem; the control methods for hepatitis are not yet clearly defined, but it has been well established that lack of sanitation is an important factor in its spread. If another war should ever occur,

these same diseases will again be of major importance, and we should be ready to control them. However, the present organization of the military for utilizing the non-medical skills so necessary for such control is hopelessly inadequate.

## The Cost of Construction

Construction costs are stabilized or declining slightly, and are now about 10% below the recent peak of last October. These data, and other information on current construction conditions, are based on a survey recently made by the Associated General Contractors of America. This survey was nationwide. Of the contractors reporting, 50% said that costs have stabilized; 43% that costs were still going down. In regard to materials, 94% said the supply was adequate; and 92% said the supplies of equipment were adequate. Manpower was reported as ample by 94%, and 79% said there was an increase in worker productivity.

These factors point up to the fact that now is a good time to start those needed public works.

## The Most Desirable Personal Characteristics

According to a recent research report, if you want a better engineering job, you must look intelligent, act dependable, and at least pretend an interest in the details of the organization. And if you want a sales job, you should exude energy and health, keep your shoes shined and wear a clean shirt. These data are a liberal interpretation of a report of a sub-committee of the Engineers' Council for Professional Development.

Six desirable characteristics were selected and, for general engineering, were ranked, after trial, in the following order: Intelligent; dependable; organizationally acceptable; dynamic (or energetic); emotionally acceptable; and physically acceptable. For sales and distribution work, the rankings were: Dynamic, physically acceptable; emotionally acceptable; intelligent; and organizationally acceptable. Other rankings were given for research, design and other fields.

There has long been a need for a good method of classifying personnel. The report does not go into the details of doing this, or give any methods for determining a man's standing in any of these categories; but it is a step forward. However, we feel that one important item was omitted—imagination. That quality is a necessity if a man is to be a leader.

We hope that this committee or another one will try to develop ways and means of selecting personnel. It is no kindness to a man to give him a job he can't do; disappointment, possibly permanent damage to the man, and a poorly done job are the results.

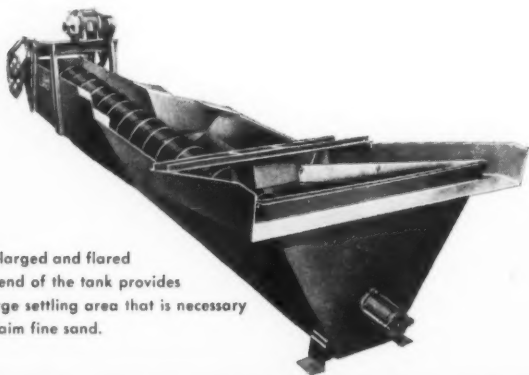
## MICHIGAN WASHING PLANT



**The Same Clean-Cut  
Engineering that  
Characterizes Every A-W  
Rock and Gravel Plant**

Here is a complete gravel crushing, screening and washing plant for the production of aggregate for use in building or highway construction.

With the sizes of units used, total plant capacity is approximately 100 tons per hour. If desired, larger units could be used to increase production to 200 tons per hour, or more.



The enlarged and flared lower end of the tank provides the large settling area that is necessary to reclaim fine sand.

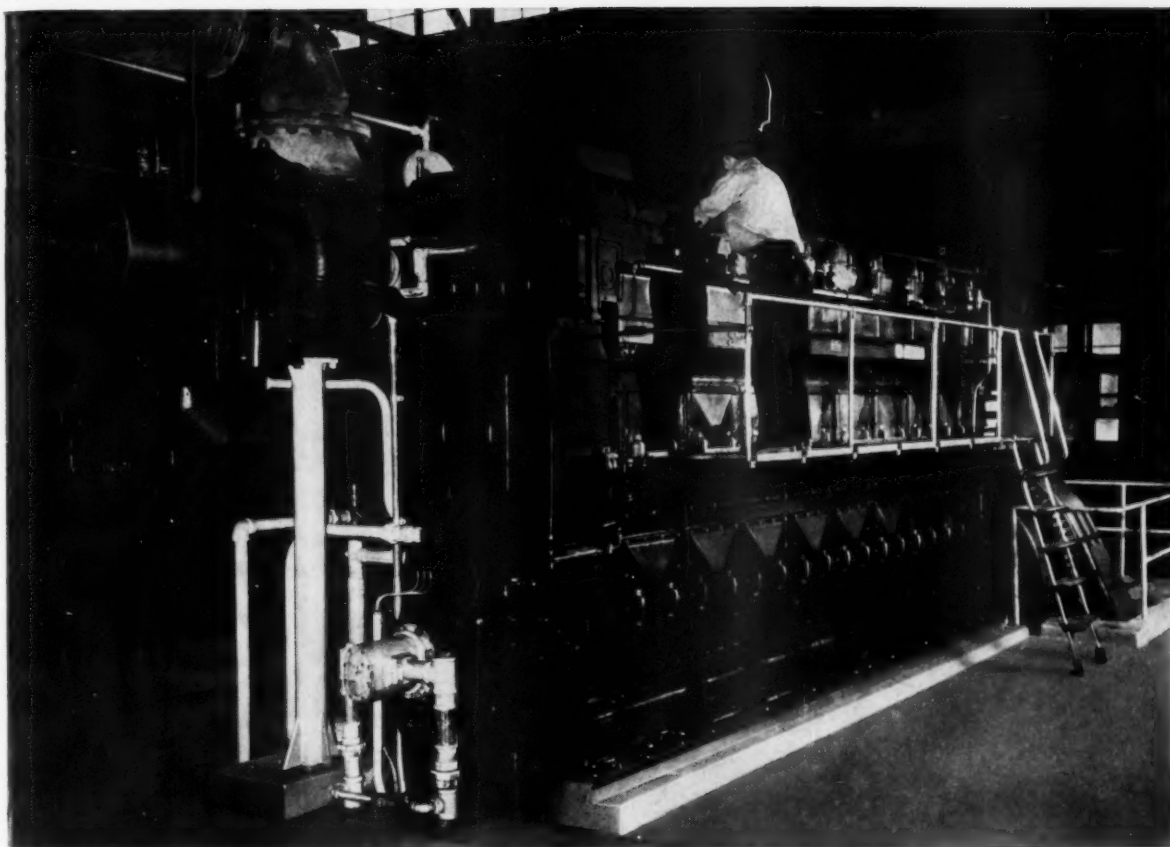
The plant has facilities which insure the production of properly washed and graded aggregate—a fine and a coarse sand, and two sizes of stone. If desired, additional sizes of product can be made.

Because of the simple arrangement, operating costs are held to a minimum. One man is all that is needed to operate the plant. A generator set provides power for the entire plant, including a water pump using about six gallons of fuel per hour.

Two Eagle Fine Material Screw Washers, of the type shown in the accompanying photograph, operating in series, deliver the two sizes of clean graded sand. Similar washers, but without the flared lower end, are used for the stone, to insure the thorough scrubbing action which guarantees clean rock.

**AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U. S. A.**

BUILDERS OF ROAD MACHINERY  
**Austin Western**  
SINCE 1889



## THERE WAS WATER FOR EVERYTHING ... but only a trickle for power

In 1948 one of the largest power plants in the East was faced with a serious lack of water for hydro-electric power purposes.

They knew they had to prevent a power shortage ... so they decided to install a Diesel generating unit just as quickly as possible. Officials of this utility company contacted our Superior Engine Division and told them about their problem.

In just 72 days from the time the order was placed, Superior had delivered and helped complete the installation of a 1000 KW generator unit, powered

by an 8 cylinder, 1440 hp. turbo-charged Superior Diesel. This installation proved so successful that recently they ordered another Superior.

Yes, you can depend on our Superior Engine Division for outstanding service whenever it is needed. And you can be sure that Superior Diesels will provide an equally dependable source of power. We would appreciate an opportunity of showing you the advantages they offer.

**THE NATIONAL SUPPLY COMPANY**  
SUPERIOR ENGINE DIVISION

Plant and General Sales Office: Springfield, Ohio



*Superior*  
**DIESEL**

When writing, we will appreciate your mentioning PUBLIC WORKS

# Motorists Draft Pleas To Halt Rock Salt Use

New engagements loomed today in the city's great rock salt war.

While city aides stayed mum on new reports that...

salt series  
testing  
to subm...

The...  
will ask  
salt on...

One...  
was in...

engineer  
submit  
Council  
meeting

Two M...  
Anot...

pared  
in ch...  
said  
citizen  
as n...  
lives

A...  
ready  
Rice  
M...

ual  
trial  
draw

## NO COMPLAINTS ABOUT SALT USE—WHEN YOU MIX IN 1% OF BANOX

Salt is one of the most convenient and efficient means for keeping winter streets and highways safe. But motorists complain of the damage to their automobiles from the resulting slush—and blame it on the salt.

There are no complaints about salt use when you mix in one percent of Banox—as more than 50 communities proved to their own satisfaction last winter.

Any slush—from pure water to the most heavily saturated brines—is virtually non-corrosive when treated with Banox. It's easy on the budget. Banox costs little—now even less than last year—and saves you and your taxpaying motorists much. It is the ounce of prevention which saves far more than a pound of repair bills.

Prove to yourself the effect of Banox against corrosion. Run your own simple, conclusive tests with samples of Banox and steel test strips, which are furnished on request.

For full information, write to Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa.

### BANOX IN BRIEF

- Works in any type of slush.
- One pound treats 100 pounds of salt.
- Protection lasts through later thaws and rains.
- Odorless and harmless to skin, eyes, clothing, plants, trees.
- Can't harm paint, automobile finishes or tires.
- Protects both rusted and freshly exposed metal.
- Costs less than 2¢ per capita per year.

\*Registered trade-mark of Calgon, Inc.

## CALGON, INC.

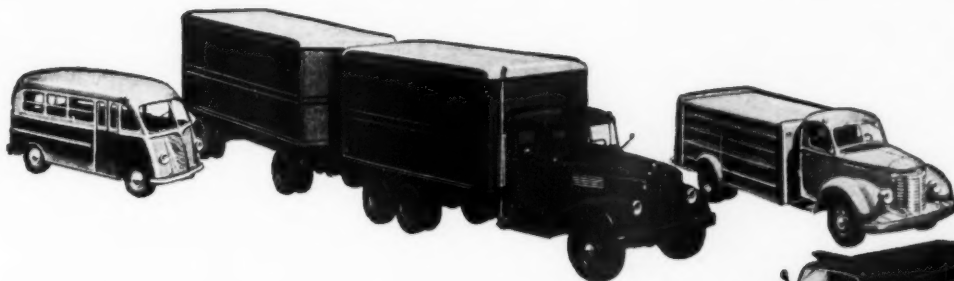
Hagan Building

Pittsburgh 30, Pa.

# Choose from America's



# most complete line of trucks



# for these 4 reasons

**1** International Trucks are specialized for the job. International builds America's most complete line of trucks. It offers 22 basic models, 1,000 truck combinations ranging in gross vehicle weights from 4,400 to 90,000 pounds. It also offers 13 truck engines (gasoline, diesel, butane) as well as specialized units and parts, to satisfy individual hauling requirements. An International sales engineer who knows your business in terms of trucks helps you analyze your own hauling needs and select the right International Trucks to meet them.

**2** For the 17th straight year International Trucks lead in heavy-duty sales. The country's most exacting truck buyers are the men who buy trucks of 16,001 pounds GVW and over. Their vote of confidence in Internationals is based on truck value—the same truck value found in every International... light, medium, and heavy-duty.

**3** More than half of all International Trucks ever built—in 42 years—are still at work. International has been building rugged trucks uncompromised by passenger car design or construction since 1907. International Trucks are built to last—and they do.

**4** International Trucks are backed by America's largest exclusive truck service organization. 4,700 Dealers and 170 Company-owned Branches offer complete International Truck service wherever you drive a truck. Precision-engineered replacement parts, factory-rebuilt exchange units, and factory-trained mechanics are as close as your telephone. For the right truck to solve your hauling problems, see your nearest International Dealer or Branch.



International Harvester Builds McCormick Farm Equipment and Farnall Tractors... Motor Trucks... Industrial Power... Refrigerators and Freezers  
Tune in James Melton and "Harvest of Stars," NBC, Sunday afternoons

## INTERNATIONAL



## TRUCKS

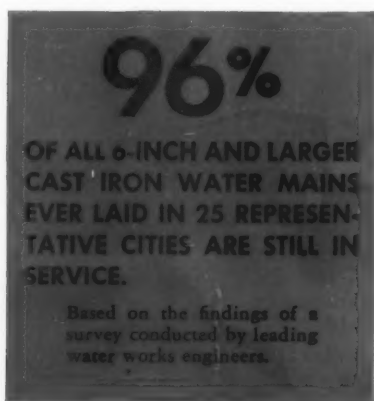
INTERNATIONAL HARVESTER COMPANY • CHICAGO

When writing, we will appreciate your mentioning PUBLIC WORKS

# The pipe that keepsw

*Number One Factor* in the low cost of water is cast iron pipe. Conceding the efficient, faithful services of water works personnel, it nevertheless is a fact that the long life of cast iron pipe is the principal factor in keeping water service cheap.

Consider the fact that well over half of the cost of a water



supply system is for distribution mains.

If the mains had to be taken up and replaced every 30 years or so, and bonds issued to pay for it, the cost of water service would mount. But cast iron mains serve for centuries—*have* served for centuries in the older cities of Europe.

In America, a survey conducted by water works engineers shows that 96% of all six-inch and larger cast iron water mains ever laid in 25 representative cities are still in service.

And when you realize that more than 95% of the pipe in America's water distribution systems is cast iron pipe, you will approve the headline of this advertisement. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Ave., Chicago 3.

## CAST IRON PIPE

# Water service cheap!



## E Serves for centuries

# The NETCO CATCH BASIN CLEANER

With Pneumatic Controls

A Necessity For  
Every Municipality



- Simple
- Positive
- Powerful

## PNEUMATIC BUCKET

Although it has large capacity, the Netco Bucket will operate through an opening as small as 16 inches. This Bucket will easily remove sticks, stones, bottles, wire, and other such debris from all catch basins.



These Cities and Many  
Others Own One or More

### Netco Catch Basin Cleaners

Boston, Mass.  
New York City, N. Y.  
Indianapolis, Ind.  
New Brunswick, N. J.  
Harrison, N. J.  
East Cleveland, Ohio  
Binghamton, N. Y.



- The Netco Catch Basin Cleaner can be mounted on any short wheel base truck having at least 8 ft. in back of cab. You can purchase unit separately and mount on your own chassis.
- The Netco Unit can be removed from truck and chassis in 30 minutes.
- The Netco can be operated continuously because the material removed from catch basins is loaded into other trucks. This unit will average 20 to 30 catch basins per 8 hour day.
- The Netco Bucket closes pneumatically, assuring positive and maximum digging efficiency.
- Positive and simple control of pneumatic bucket, boom swing, hoist clutch and boom brake by compressed air.
- The Bucket is lowered and raised by one cable. Only one hose is required to close it, and it is opened by powerful spring action.
- The Netco has a hoisting capacity up to 1500 lbs.

## NETCO DIVISION

CLARK-WILCOX COMPANY  
118 Western Avenue  
Boston 34, Massachusetts

For  
Complete  
Details  
Contact

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97



### ROOTS IN SEWERS

I have just read your editorial in the August issue of PUBLIC WORKS and again you have my wholehearted agreement. . . . The reasons why leaky joints in sewers cannot be avoided are (a) poor construction; (b) poor inspection; (c) carelessness; and (d) a mad rush to speed up what should be a slow and careful piece of work. I have always found rootproof and leakproof joints where people took a pride in their work.

Benjamin Eisner,  
Chief Engineer,  
Clay Sewer Pipe Association

### MORE ABOUT ROOTS

I read with much interest your editorial in the August issue of PUBLIC WORKS. I agree that the answer to root stoppage is better joints, but in existing sewers where roots have taken command, the problem is different. What is the correct application of copper sulfate?

E. B. Schmid,  
Commissioner of Utilities,  
Schuyler, Nebr.

(The information has been sent to Mr. Schmid—Ed.)

### SERVICE CHARGE FOR REFUSE COLLECTION

Can you tell us how many cities in the United States assess a garbage or refuse collection charge?

A. E. Williamson, Jr.,  
Daytona Beach, Fla.

(Ed. Note: Probably not more than 15% of the cities which have municipal collection of refuse pay for it by means of a special collection fee. Most of them take the cost out of general funds. However, around 50% of all communities collect refuse by contract, and in the great majority of cases, the contractor collects a fee directly from the householder. We would be glad to have data from our readers on this.)

### MALARIA CONTROL MEN WANTED

Dr. Paul Russell tells me you might be kind enough to suggest names of malariologists or malaria

control engineers who would be willing to consider a position with the World Health Organization. It is likely that this year, and in 1950, personnel for our malaria control teams will be required. These teams demonstrate modern methods of malaria control to requesting governments. Should you know of any recommendable malariologist or sanitary engineer likely to accept a one or two-year contract with WHO for such a purpose, I would highly appreciate it.

E. J. Pampana, MD,  
Malaria Section, WHO,  
Geneva, Switzerland.

## BOOKS IN BRIEF

### REFUSE COLLECTION & DISPOSAL

This is a bibliography of material published during the years 1940 to 1948. The listings do not include abstracts, but there are nearly 1,000 entries from US, British and foreign journals. It covers street cleaning, garbage collection and incineration, garbage grinding, feeding of garbage to hogs, and operation of sanitary land-fills. 66 pages. Sent on request to the Surgeon General, Public Health Service, Washington 25, D. C.

### BIBLIOGRAPHY ON SOIL MECHANICS:

This is a bibliography, prepared by the Highway Research Board, covering the papers presented at the Conference on Soil Mechanics and Foundation Engineering at the Hague last year. The papers are listed under a classified subject and author index. English translations of titles are given. Highway Research Board, 2101 Constitution Ave., Washington, D. C.

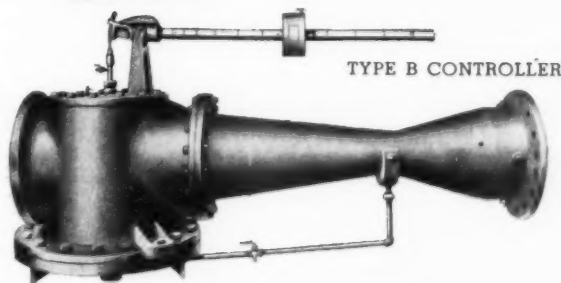
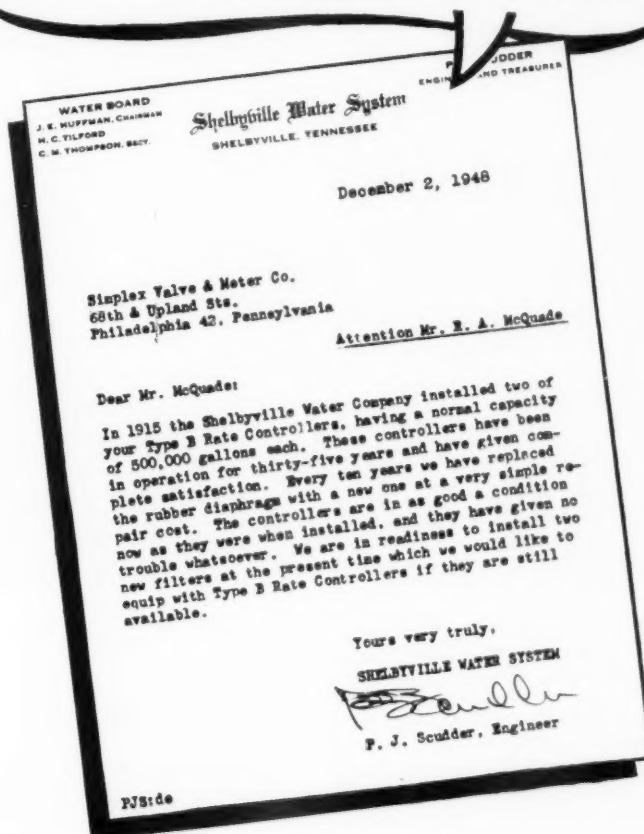
### STRUCTURAL DESIGN IN METALS

The authors of this book are Clifford D. Williams, Head Professor of Civil Engineering, University of Florida, and Ernest C. Harris, Chairman, Department of Structural Engineering, Fenn College. They say this book is intended to provide the material for a coordinated course of instruction in structural design of metals for students in the junior year at the average engineering college. The book is clearly written and the illustrations are good. It should be extremely useful for the engineer who is only occasionally engaged in structural work and needs from time to time to refresh

Here's proof **SIMPLEX** is the finest...

**"IN OPERATION 35 YEARS—  
COMPLETE SATISFACTION"**

...says P. J. Scudder, Engineer, Shelbyville Water System



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The Simplex Valve & Meter Company, Dept. 10, 6750 Upland Street, Philadelphia 42, Pa.

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VALVE AND METER COMPANY

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# it DIGS...it LOADS

at tremendous savings



Whether you need it for excavation work or loading from stockpiles or both, you need the new low production cost of the Dempster-Diggster. Here is the only small shovel that works on a hydraulic, simultaneous or independent crowd and hoist action and completely eliminates tractive effort in loading with wheels. Its variable crowd action at any dipper position means the Dempster-Diggster can dig lower . . . 15 inches below grade. Exclusive hoisting action means it can dig higher . . . digs out a 15 ft. bank. It's the only small shovel featuring such speed and mobility . . . travels at truck speeds on the road . . . gets in tight places on big jobs, freeing large shovels for heavier work. Ideal for the small and medium size excavation jobs yet powerful and fast enough for big jobs.

Stockpiling or loading work is easy for the DEMPSTER-DIGGSTER. Its speed . . . its 15 ft. turning radius . . . its extraordinary dumping reach help the Dempster-Diggster complete the average loading job in an amazingly short time. Dempster-Diggster buckets are easily interchangeable and are available in three sizes. 1 cu. yd. (heaped) with hardened steel teeth for digging . . . 1½ and 2 cu. yd. for loading and stockpiling work. Power is supplied by a heavy duty gasoline or diesel engine. Hoisting, crowding, steering and braking are all 100% hydraulic. For complete information, write today for Folder Number 8154.

**DEMPSTER  
BROTHERS**  
INC.

Large photo above shows Dempster-Diggster loading crushed stone. Note how independent crowd and hoist action permits bucket to follow the slope of the material. At right, top: Digging out high bank. Right, center: Closeup of 1 cu. yd. (heaped) digging bucket. Right, bottom: Dumping crushed stone into truck.



9109 DEMPSTER BLDG.

KNOXVILLE 17, TENN.

himself on the elements of the subject. Ronald Press Co., N. Y. 590 pages; illustrated; \$6.50.

#### SEWAGE WORKS ACCOUNTING

This is a manual of practice issued by the Federation of Sewage Works Association, and the full title is "Uniform System of Accounts for Sewer Utilities." It adapts to sewer utilities the basic accounting system that has been used successfully in water works and other fields. Mimeographed; 117 pages; \$5. Address the Federation at 325 Illinois Building, Champaign, Ill.

#### POSITIONS AND JOBS

A large corporation, which is developing a sewage treatment division in addition to its existing services in water supply, will require the services of one to three sanitary engineers. Your editor believes that the opportunity is an excellent one for a well-qualified engineer who desires to enter the business field. Write to the Editor, attention, CS.

A manufacturer of sewage treatment equipment in the mid-west needs an experienced sanitary engineer to aid in its sales program, and to contact municipalities and consultants. Write the Editor, attention TJ.

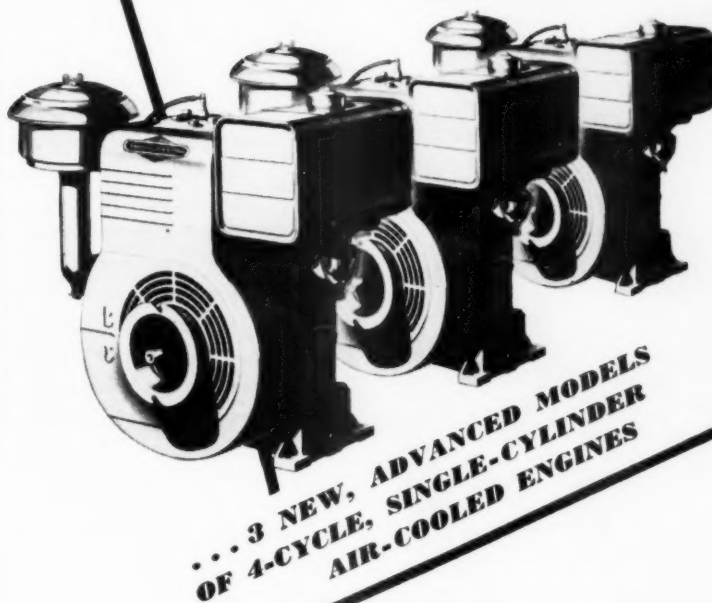
Graduate engineers under 31 years old are wanted by the Coast Guard. Commissions in the reserve, in the grade of Lt. (j.g.) or Ensign will be granted, with consideration for a permanent commission after two years of active duty. Write U. S. Coast Guard, Washington 25, D. C.

Three qualified engineers are wanted for studies and surveys on water pollution. Salary is \$3,120 per year. Communicate with A. H. Fletcher, Director of Environmental Sanitation, State Dept. of Health, Trenton, N. J.

Competitive examinations for appointment as sanitarian in the Public Health Service will be held Dec. 12-14; applications must be received by Nov. 14. Write Division of Commissioned Officers, Public Health Service, Washington 25, D. C.

Sanitary Engineer Available. — College graduate, 34, married, 12 years experience in public health, industrial waste, research, sewage and water, desires position with industrial organization in waste treatment, development and operational work. Write the Editor, attention RR.

## From Air-Cooled Power Headquarters



Compact — powerful — in brilliant modern design — incorporating many important improvements — these new Briggs & Stratton models are perfected products of the world's largest builders of 4-cycle air-cooled single-cylinder engines, resulting from an experience record spanning more than 30 years and a production record of more than 4 million engines.

These new engines set new standards of value, dependability and performance as "preferred power" for machines, tools and equipment used in industry, and construction, by railroads and on farms.

Complete technical information is available on these new Briggs & Stratton single-cylinder 4-cycle air-cooled gasoline engines:

MODEL "9" 3.1 H.P.

MODEL "14" 5.1 H.P.

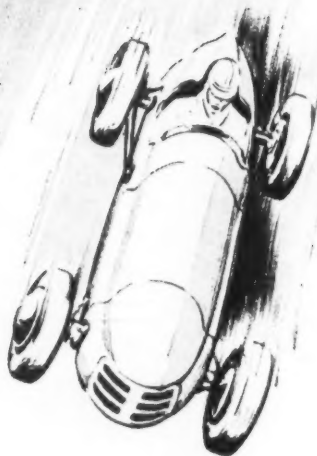
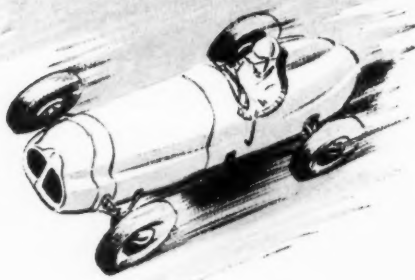
MODEL "23" 8.25 H.P.

BRIGGS & STRATTON CORPORATION, MILWAUKEE 1, WIS., U.S.A.



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speeding construction jobs  
is like winning "the 500"



It takes fast and accurate driving to win the famous speedway classic. On municipal construction jobs, the fast and accurate driving you get with Armco Steel Sheeting is also a winner. Jobs are done quickly and at low cost.

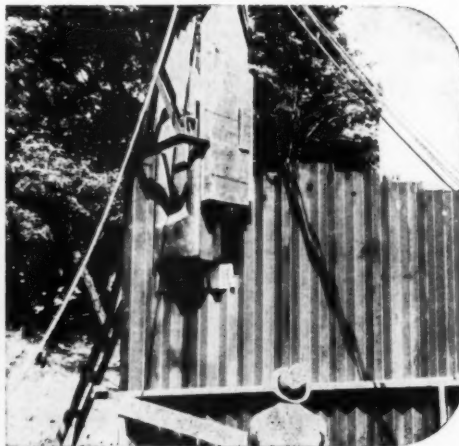
Light weight and a small displacement area make Armco Sheeting easy to handle and drive. The work goes fast with either a hand maul or a power hammer. You'll find that Armco Steel Sheeting can generally be driven to penetration before excavation.

On temporary jobs Armco Sheeting can be readily pulled and re-used over and over again. A convenient hole near the top of each section facilitates pulling. Storage is no problem because individual units nest together to save space.

You'll like Armco Steel Sheeting for shoring trenches, building core walls and cofferdams, shore protection and similar uses. Write for complete data. Armco Drainage & Metal Products, Inc., 4009 Curtis Street, Middletown, Ohio. Subsidiary Armco Steel Corporation. Export: The Armco International Corporation.



**ARMCO STEEL SHEETING**

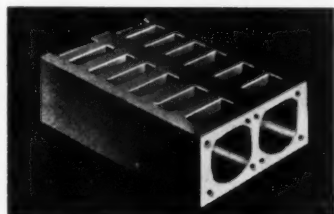


When you need special information—consult READERS' SERVICE DEPT. on pages 93-97

# ARMCRE UNDERDRAINS

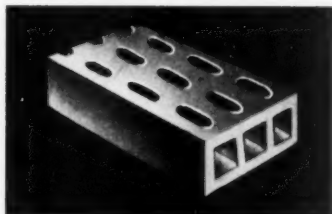
**When you buy ARMCRE you buy the complete floor**

ARMCRE—the standard of underdrains—is used in more installations, both municipal and federal, than any other block on the market



**Armcre Standard Block**  
5 x 10 x 16

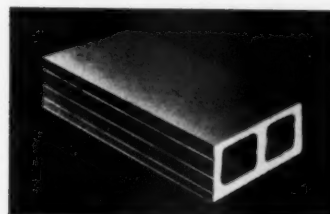
For best results in all standard types of filters.



**Cover Plates**

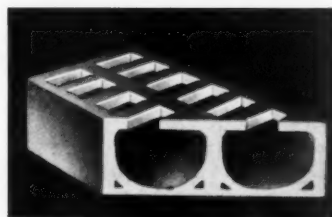
4 x 8 x 16 to 4 x 8 x 30

Perforated cover plates and plain for covering drainage channels.

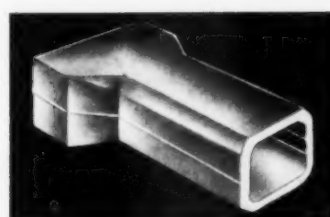


**Armcre High Rate Filter Block**  
7 1/2 x 10 x 16

For use in high rate filters assuring sufficient drainage, aeration and cross ventilation.



**Angle Cuts** — For use around the periphery of the bed assuring maximum drainage and aeration.

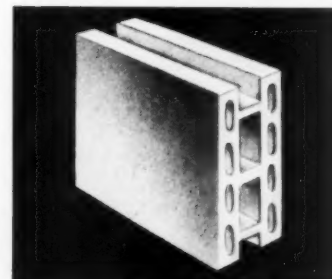


**Reducer and Reducer Extension**  
10 x 5 x 7 1/2 x 16

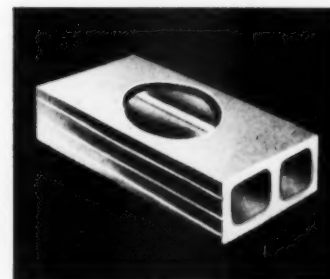
For passing through walls to drainage channels.

## SPECIAL FEATURES

All ARMCRE blocks are made from fire clay, vitrified and salt glazed. It is a one-piece unit.



**Tank Blocks** — 6 x 12 x 12 tank blocks for outside walls of trickling filters.



**Cover Vent Blocks**  
4 x 8 x 16 to 30  
With openings to accept 4" or 6" vent pipe.

We furnish free an estimate of the quantities needed, and a lay-out of the floor for the contractor to use in the field.

## No Finer Filter Blocks Made Than ARMCRE

For further information we refer to ASTM Designation C159-48T Specifications for Vitrified Clay Filter Block for Trickling Filters.

**WRITE FOR ESTIMATING COSTS**

**AYER-McCAREL-REAGAN CLAY CO., Brazil, Indiana**

FACILITIES OF THREE PLANTS INSURE PROMPT SERVICE

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Closeup of workmen drawing up Dresser Style 38 Coupling at shore end of Saginaw, Michigan, intake.

## THEY DID THIS UNDER WATER AT SAGINAW-MIDLAND

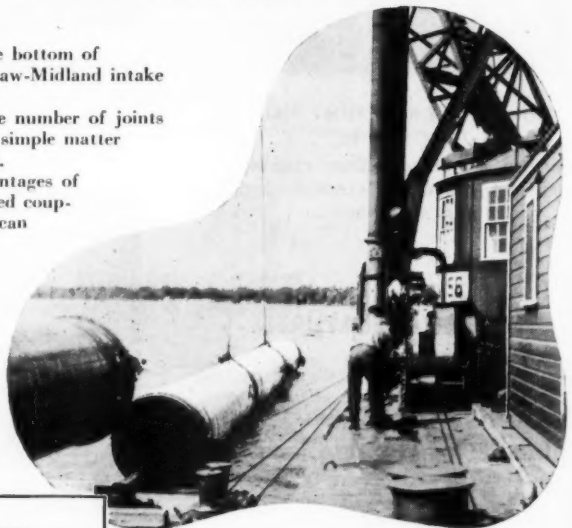
Picture yourself in a diving suit, joining 66-inch pipe on the bottom of Lake Huron, and you'll readily appreciate why the new Saginaw-Midland intake is a Dresser-Coupled steel line.

The longer pipe sections possible with steel minimized the number of joints to be made under water, and the use of Dressers made it a simple matter for a team of divers to join the sections uniformly bottle-tight.

Jobs like this are dramatic proof of the installation advantages of Dresser-Coupled steel lines. These factory-made, factory-tested couplings eliminate the variables in pipe joining. Any workman can install them, using only a wrench. You get a perfect joint every time, with the added feature of flexibility to absorb stresses and accommodate deflected or offset pipe.

Furthermore, with Dressers, you get the full advantage of modern coatings and glass-smooth linings. Dressers fit outside the pipe. There is no heat to damage the lining, no need for workmen to go inside the pipe.

For simplicity, dependability, and maximum safety margin, specify a Dresser-Coupled steel line. Write today for detailed information.



This is how sections of steel pipe were lowered to divers working on lake bottom. Coupling parts are already in place on plain pipe ends.

### Partial list of cities using Dresser-Coupled steel lines

Boston, Mass.  
Newark, N. J.  
Springfield, Mass.  
Cleveland, Ohio

Kansas City, Mo.  
Portland, Ore.  
Oakland, Cal.  
Savannah, Ga.

Jersey City, N. J.  
Syracuse, N. Y.  
Milwaukee, Wisc.  
Philadelphia, Pa.

# DRESSER

"FLEXIBLE-TIGHT"  
**COUPLINGS**

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries)—In Texas: 1121 Rothwell St., Houston—In Canada: Dresser Mfg. Co., Ltd., Toronto, Ont.—Sales Offices: New York, Chicago, Houston, San Francisco.

When you need special information—consult READERS' SERVICE DEPT. on pages 93-97



# More Than 250,000 HOMELITE UNITS

Pumps • Generators • Chain Saws • Blowers • Paving Breakers

Are on the Job

*Everywhere*



## HOMELITE PUMPS

Everywhere... even in the most remote places... wherever water has to be pumped out fast and with the least trouble you'll find Homelite Carryable Gasoline-Engine-Driven Pumps in action.



## HOMELITE GENERATORS

For operating electric tools... both high-cycle and standard 110 volt... and for operating floodlights, Homelite Carryable Gasoline-Engine-Driven Generators are the ever-ready, ever-dependable favorites everywhere.



## HOMELITE CHAIN SAWS

Lightweight, compact, safe and easy to handle, these one-man, high-cycle electric chain saws have super-fast cutting power and are rugged and dependable for all types of cutting on both tree work and construction jobs.



## HOMELITE PAVING BREAKERS

More and more the new 84-lb. Homelite Electric Paving Breaker is being enthusiastically received by those who want a fast, efficient breaker that is compact and easy to move.



## HOMELITE BLOWERS

Where ejecting smoke or supplying fresh air is a must for safety and efficiency, Homelite Carryable Gasoline-Engine-Driven Blowers are constantly on the job.



## HOMELITE SERVICE

In all parts of the country Homelite representatives are ready to demonstrate the advantages of Homelite units and to service most efficiently all Homelite equipment.

# Homelite Corporation

2110 RIVERDALE AVENUE, PORT CHESTER, NEW YORK

Manufacturers of

Homelite Carryable Pumps • Generators • Blowers • Chain Saws • Paving Breakers

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See how Homelite Equipment can save time, trouble and money for you. Send for descriptive bulletins on any or all of the equipment shown above.

# KEEP TRAFFIC MOVING

— Change from Out-Moded Abrasives

## GET "BARE-PAVEMENT" MAINTENANCE WITH

### **SAFE**

Sterling Auger-Action Rock Salt will not harm black top or brick pavements. NOR WILL IT HARM CONCRETE SLAB FOUR OR MORE YEARS OLD, NOR AIR-ENTRAINED CEMENT.\*

\*Authority: Portland Cement Association

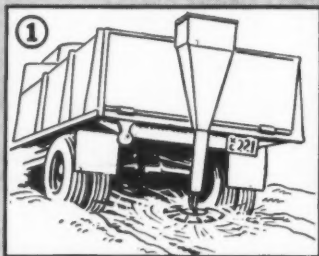
### **FAST**

One truck of Sterling Auger-Action Rock Salt will cover 10-15 miles before reloading. One truck with abrasives will cover only 1½ miles before reloading. THUS SALT IS APPLIED IN 1/10th THE TIME OF ABRASIVES.

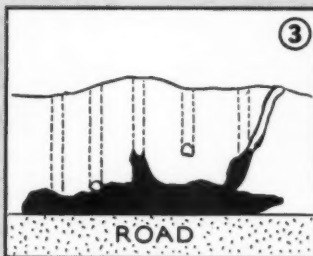
### **EASY**

Sterling Auger-Action Rock Salt is easy to store. It can be used in any mechanical spreader. No vari-sized chunks. No freezing. LEAVES NO RESIDUE TO BE CLEARED FROM ROADS AND SEWERS!

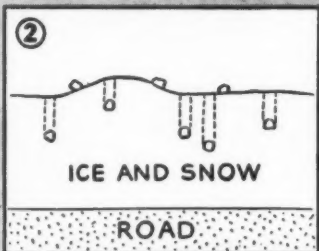
## HOW STERLING **AUGER-ACTION** ROCK SALT WORKS



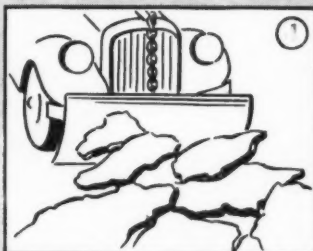
Sterling Auger-Action Rock Salt can be used in any mechanical spreader. Requires no special treatments.



Salt crystal reaches pavement . . . becomes brine. Brine BREAKS THE BOND between road surface and ice.



Each Sterling Auger-Action Rock Salt crystal bores a hole its own size in ice or snow.



Broken ice can be removed with one pass of plow or scraper. Heavy traffic spots clear themselves with passage of vehicles.

# STERLING

# ICING EVERY DAY THIS WINTER AT 1/2 THE COST

ded Abrasive Chemical Methods—

ANCE WITH STERLING *Auger Action* ROCK SALT

## **ECONOMICAL**

These are actual figures obtained from F. Ray Williams, Supt. of Highways, Saratoga County, N. Y.

### COMPARATIVE COSTS OF PROTECTING ICY HIGHWAYS WITH TREATED SAND AND ROCK SALT

#### SAND MIXED WITH ROCK SALT:

Royalty .....	\$ .10
Loading .....	.25
Haul, 5 miles at 8¢ .....	.40
Piling with bulldozer .....	.15
Treating with salt at 50 lbs. per cu. yd. ....	.48
Reloading at time of storm .....	.25
Average haul, 10 miles at 8¢ .....	.80
Spread .....	.10
Total cost per cu. yd. ....	\$ 2.53
Use of 3 cu. yd. per mile at \$2.53 .....	7.59

#### STRAIGHT ROCK SALT:

CC Grade Rock Salt: (400 lb. per mile, computed for 5-ton load)	
5 tons of bulk salt at \$12.95 per ton .....	64.75
Loading, 5 tons at 25¢ per ton .....	1.25
Average haul (30 miles at 8¢ per ton-mile) 5 tons .....	12.00
Spread (mechanical) 5 tons at \$1.00 .....	5.00
	\$83.00
\$83.00/5 ton .....	per ton = 16.60
\$83.00/25 miles .....	per mile = 3.32

#### UNIT SAVINGS:

**\$7.59** cost per mile with treated sand

**\$3.32** cost per mile with Sterling Rock Salt

**\$4.27 SAVING PER MILE  
EACH ICING IN FAVOR OF  
ROCK SALT**

Mileage of state highways in  
Saratoga County, N.Y. = 216 miles

**ESTIMATED SAVING**

**EACH STORM =**

**216 x \$4.27 = \$922.32**

## GET READY FOR WINTER—NOW!

• Easy to store

• Comes in carloads, bulk, or handy 100 lb. bags

**AUGER  
ACTION**

# ROCK SALT



**INTERNATIONAL SALT COMPANY, INC.  
SCRANTON, PA.**

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**ROLL CALL**  
**of AMERICAN CITIES**  
 using or installing  
**NICHOLS**  
**MONOHEARTH**  
 Mechanically Stoked  
 Incinerators

Many cities and towns have solved the perplexing problem of their refuse disposal completely, efficiently and economically with Nichols Monohearth Mechanically Stoked Incinerators.

The advantages of complete incineration over city dumps, open or ground filled, is best demonstrated by the municipalities now operating Nichols Monohearth Mechanically Stoked Incinerators.

Public Works Departments are urged to investigate fully the exceptional possibilities offered by Nichols Monohearth Mechanically Stoked Incinerators.

Write for Bulletin No. 217-A



In addition: Winnipeg, Man., York and N. York, Ont., Ft. William, Ont., Moncton, N. B. in Canada. Sao Paulo, Brazil and St. Kilda, Australia.

**NICHOLS ENGINEERING & RESEARCH CORPORATION**  
**70 PINE ST., NEW YORK 5, N. Y.**

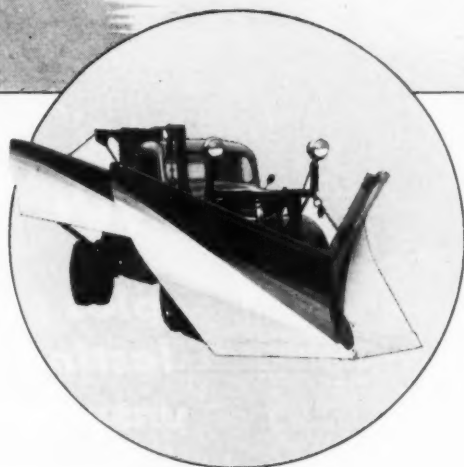
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## TAILOR MADE

to fit the **SNOW** problems in your area . . .



**NO WEDGE!  
NO SIDE THRUST!**



**NO BUCKLING!  
NO SIDE-SLIPPING!**

**E**very one of Frink's 15 snow plows is scientifically engineered for faster snow removal in any area . . . ruggedly built for more hours of continuous service . . . economically priced for any city, county, or state budget.

Frink Sno-Plows are available for trucks with capacities from 1½ to 12 tons. For further information about the plow best suited to your needs, write Box P49W, Clayton, N. Y.

### MORE FEATURES

1. Exclusive self-ballasting feature prevents nose from "riding up" and prevents slipping when widening out.
2. Full power hydraulic control permits easier, faster handling.
3. Reversible cutting edges give double wear for greater economy.
4. Hinged deflectors keep windshields free from flying snow.
5. Side-leveling wings are optional.

For further information write Box P49W, Clayton, N. Y.

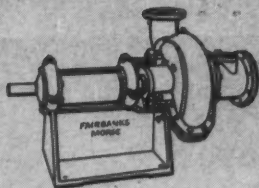


FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK

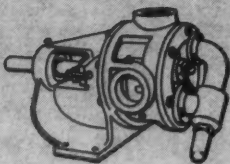
DAVENPORT-BESLER CORP., DAVENPORT, IOWA

FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

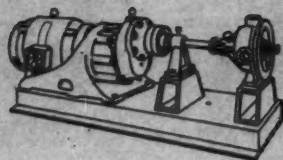
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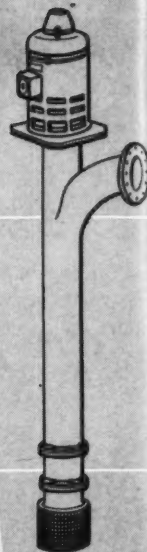
Paper Stock Pumps



Frame Constructed Rotary Pumps

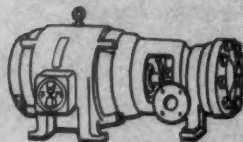
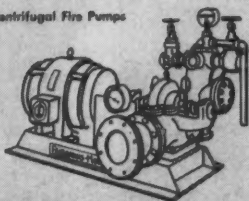


Rotary Pumps with Geared Head Motor Drive

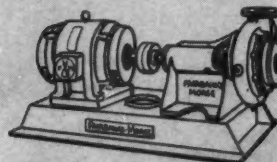


Vertical Propeller Pumps

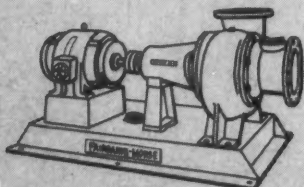
Centrifugal Fire Pumps



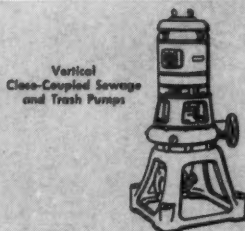
Two-Stage Bullougher Pumps



Horizontal Sewage and Trash Pumps

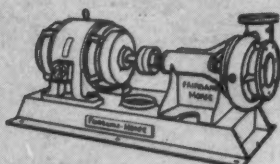
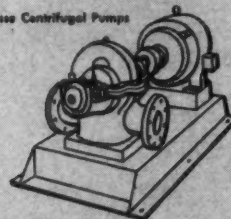


Horizontal Angle Flow Pumps

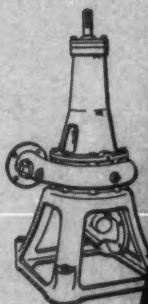


Vertical Close-Coupled Sewage and Trash Pumps

Split-Case Centrifugal Pumps

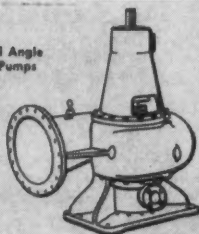


Base-Mounted Centrifugal Pumps

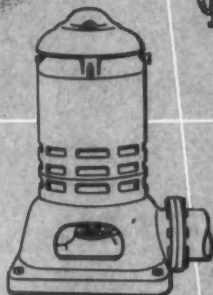


Vertical Sewage and Trash Pumps

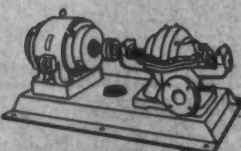
Vertical Angle Flow Pumps



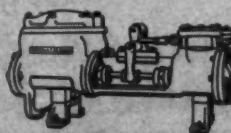
Bullougher Centrifugal Pumps



Deep Well Turbine Pumps



Two-Stage Centrifugal Pumps



Duplex Steam Pumps



8 Cover Side-Pol Duplex Power Pumps

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**THAT DELIVER**

**plus performance  
lasting dependability  
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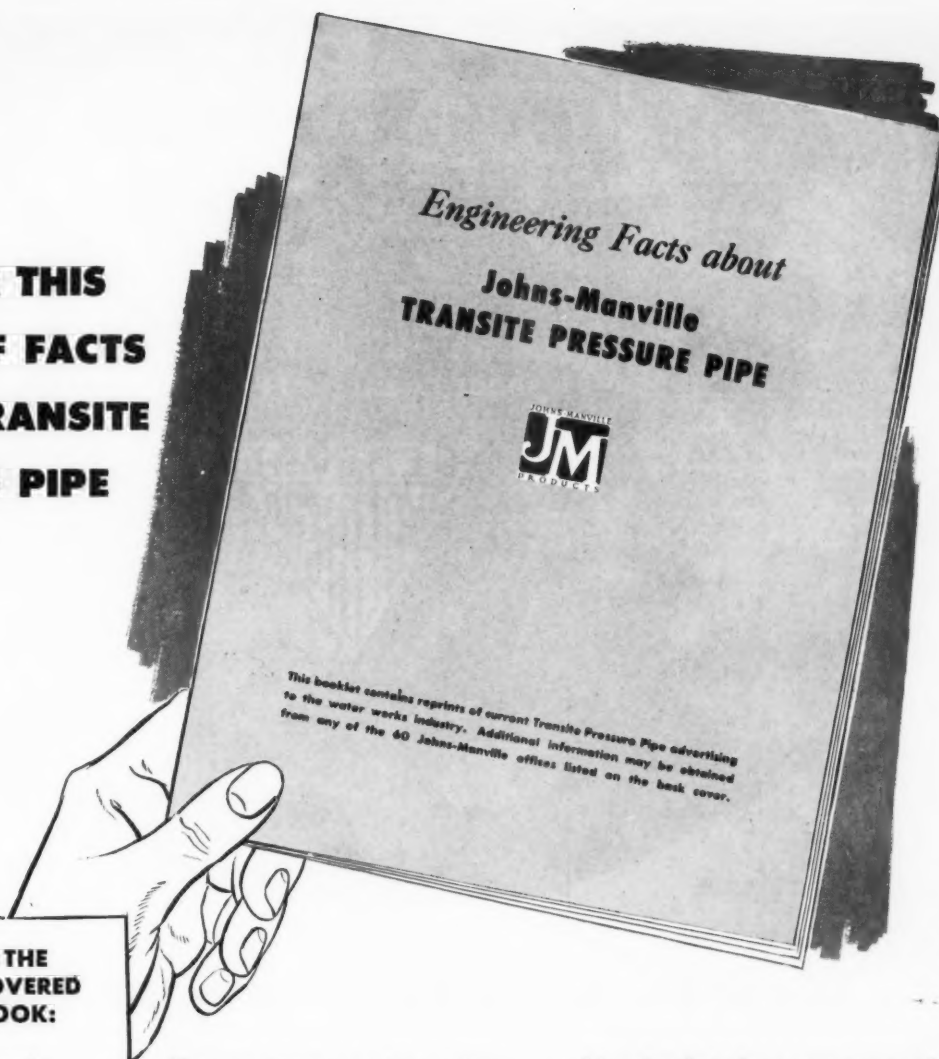


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When you need special information—consult READERS' SERVICE DEPT. on pages 93-97

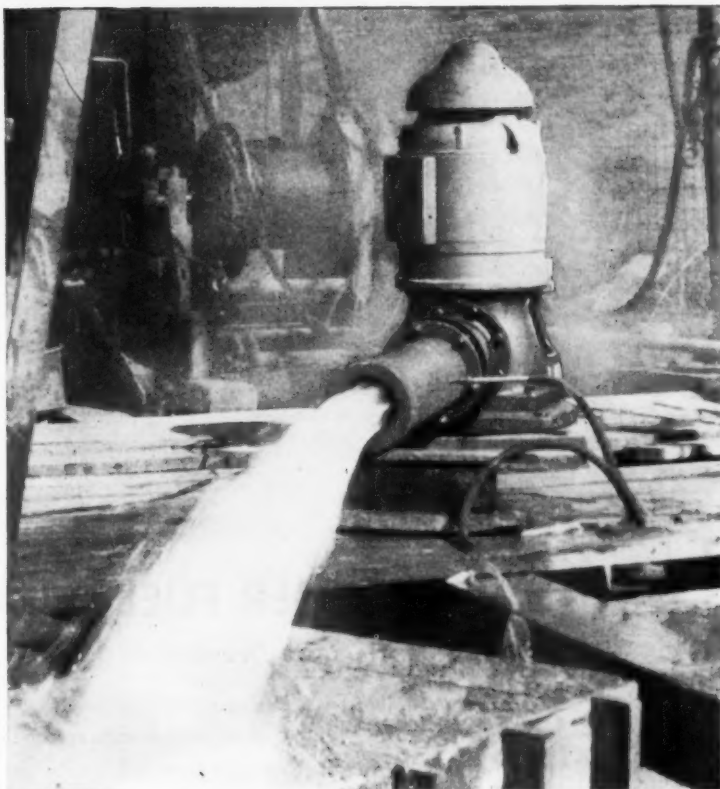
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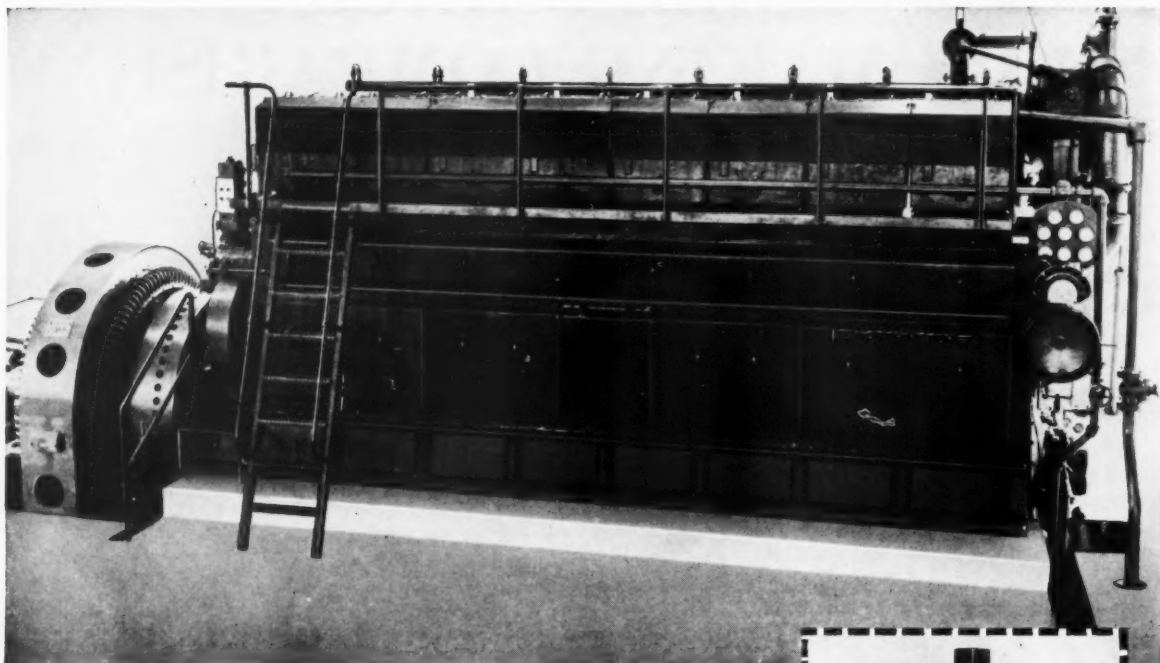
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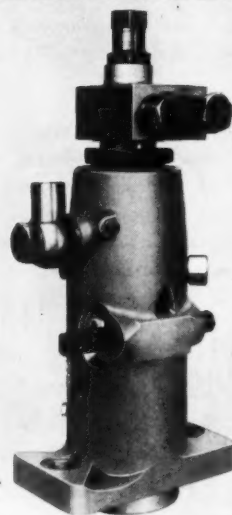
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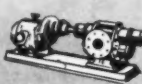
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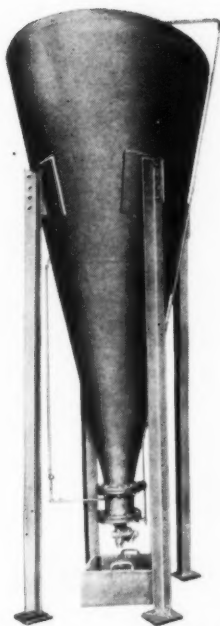
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Permutit has added new speed to lime  
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For over 35 Years Water Conditioning Headquarters

# 64 EVERDUR\* gates

in new  
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sewage treatment  
plant

**P**HILADELPHIA chose Everdur† for the 64 slide gates in its new 135-million gallon capacity Northeast Sewage Treatment Plant because of the remarkable record of these copper-silicon alloys for corrosion resistance. The gates were fabricated by the Frederick Grundy Iron Works of Philadelphia for the Virginia Engineering Company, the general contractors.

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Everdur is easy to weld. Here an Everdur angle is being welded to Everdur plate in fabricating one of the 64 gates.



Close-up of one of the gates fabricated entirely of Everdur 1010 by the Frederick Grundy Iron Works.



Settling basins under construction at new 135-million gallon capacity N. E. Philadelphia Sewage Treatment Plant by Virginia Engineering Co., Newport News, Va.



Influent and effluent channels to settling basins No. 2 and No. 3 showing 32 of the 64 Everdur gates.

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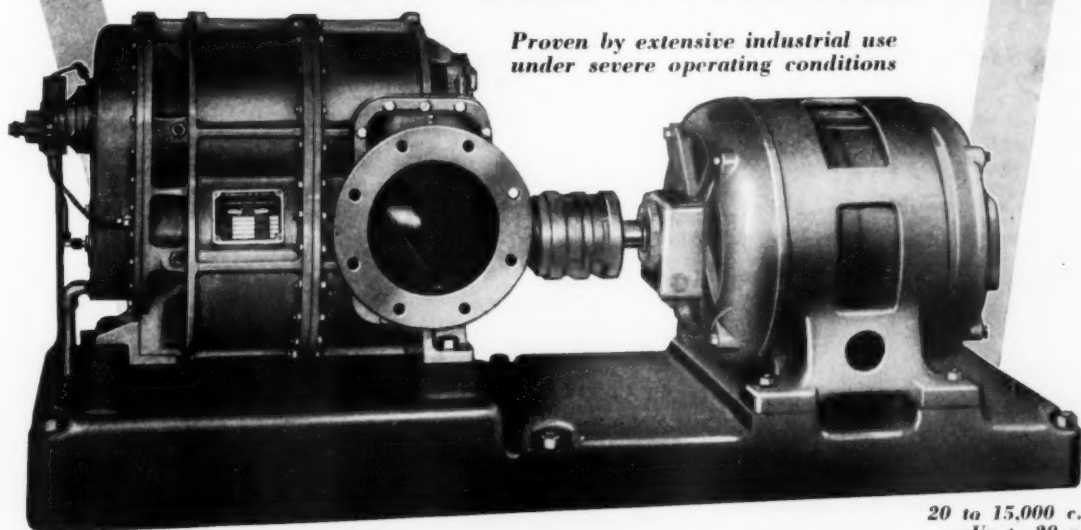
# ANOTHER STEP FORWARD

THE "Chicago"

## STANDARD AIRE BLOWER

EFFICIENT • QUIET • COMPACT

*Proven by extensive industrial use  
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20 to 15,000 c.f.m.  
—Up to 20 psi.

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No clatter or pounding. Sound level comparable to centrifugal blower.

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Requires less layout area than conventional blowers of equal capacity.

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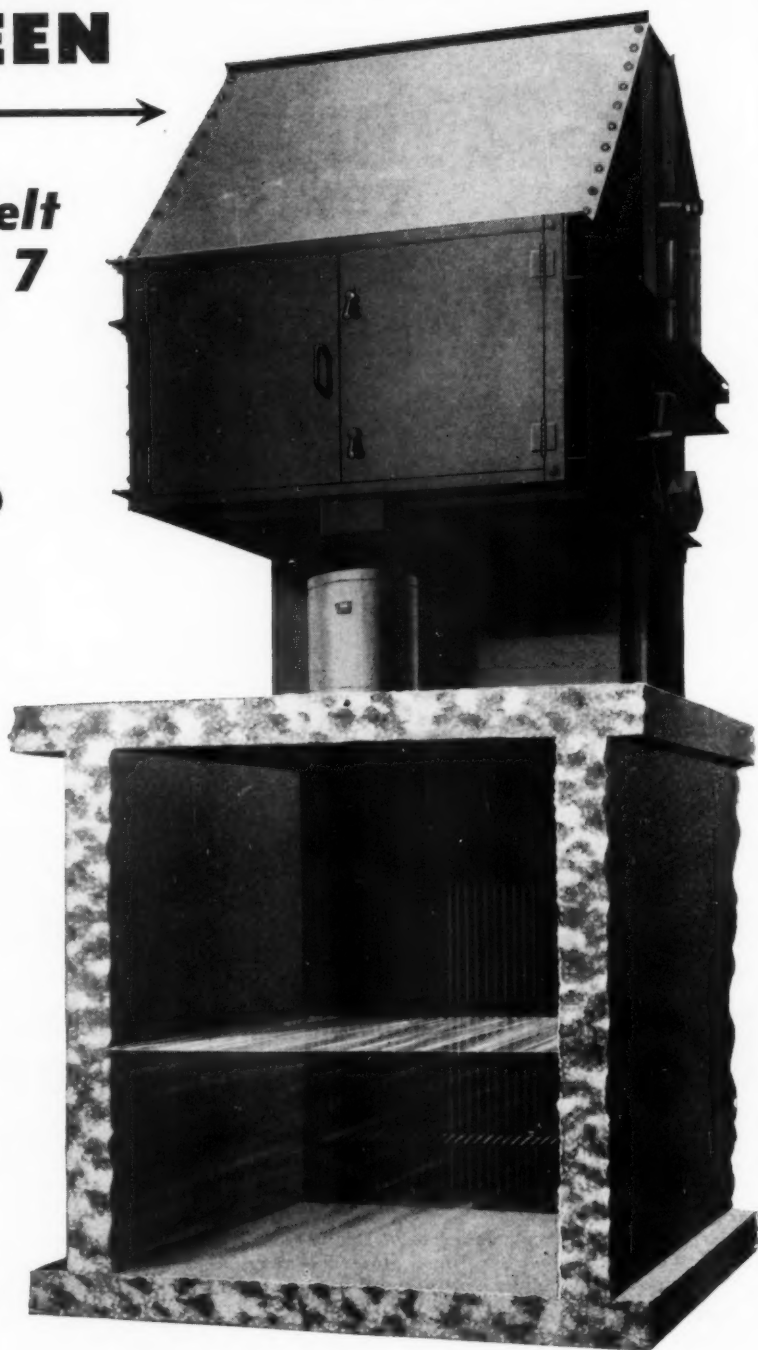
**Convention**

**Boston, Oct. 17-20**

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This screen has many distinctive features. Bottom and top support of screen bars assures alignment. Vertical path cuts down the power required to operate and results in minimum chain wear. Chain take-up is on the head shaft where it is readily accessible for maintaining proper chain tension. The screen cannot be jammed by large objects settling in front of the screen bars since the rake will enter under and lift them.

The screen is of the usual rugged Link-Belt design and is accurately constructed to give long life under the most severe operating conditions. For detailed information, get in touch with our nearest office, or inquire at the Link-Belt exhibit.



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OCTOBER 1949  
VOLUME 80 • NO. 10

# PUBLIC WORKS MAGAZINE

## How to plan effective Sewage Chlorination

**A. E. GRIFFIN**

Director, Technical Service Division  
Wallace & Tiernan Company, Inc.  
Belleville, New Jersey

**C**HLORINATION is accepted in the United States and Canada as an integral part of sewage treatment practice. As early as 1934, an APHA report included more than two hundred references on the subject. By 1946, according to a survey by the *Engineering News-Record*, 1,320 sewage treatment plants in the United States employed chlorination for one or more purposes. These reports and surveys show that chlorine is in general use for disinfection, for BOD reduction, for the control of odors and septicity and for many special purposes.

The practice of chlorination involves the application of either chlorine, its commercially prepared derivatives or those prepared *in situ*, such as chlorinated copperas, for some specific use or benefit in the sewage treatment process. Whether to use chlorine or its compounds depends upon local conditions and the purpose for which it is added. Likewise, the point or points of application depend upon the same conditions. In any event, to secure maximum results, the quality of the raw sewage, the character of the treatment structures and the desired degree of purification of the final effluent should be studied carefully before the final decision is made.

Close attention to these details may avoid costly changes at a later date.

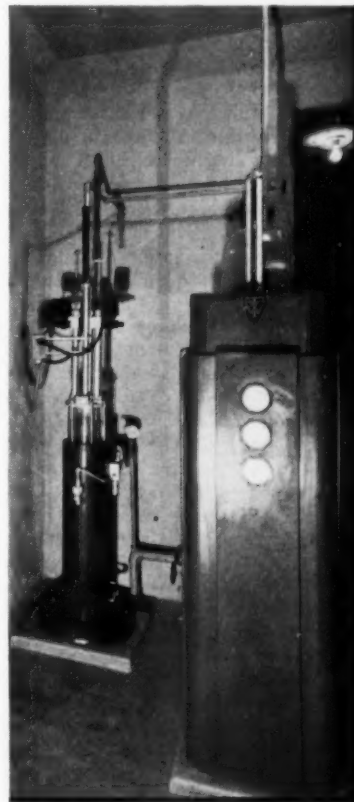
### **Terminology for Chlorine Application**

There is no complete or concise terminology for the specific points of application of chlorine but common practice has led to the general acceptance of such terms as Up-Sewer Chlorination, Pre- and Post-Chlorination, Plant-Chlorination and perhaps Aero-Chlorination. These terms, of course, refer to the position of chlorination and may have little specific relation to the reason for chlorination. They are generally used to give the reader an idea of the treatment as related to the plant as a whole.

Although the mere mention of the position or place of chlorination carries no specific connotation as to the use to which the chlorine will be put, it does have some meaning. For instance, if up-sewer chlorination is under discussion, the reader or listener would almost always infer that abatement of odors or prevention of damage to concrete structures were being considered.

One of the main uses of up-sewer chlorination is to serve as a check on the production of odors, generally those caused by H<sub>2</sub>S. Chlorine acts in two ways in this respect. Being a powerful oxidizing agent, it neutralizes any hydrogen sulphide present, turning it into sulphur and hydrochloric acid. It also prevents the production of hydrogen sulphide by destroying the bacteria responsible for the formation of this odorous gas. Its use in this respect is not

limited to up-sewer treatment because chlorine will act in a similar manner wherever applied. But up-sewer treatment is usually more effective because it prevents the escape of odors at manholes along the



● A CHLORINATOR installation at the Big Spring, Texas, treatment plant.



● **CONTROL of filter ponding by chlorination. On the left, filter before chlorine was applied; on the right, after chlorination.**

line where conditions are prone to become quite offensive.

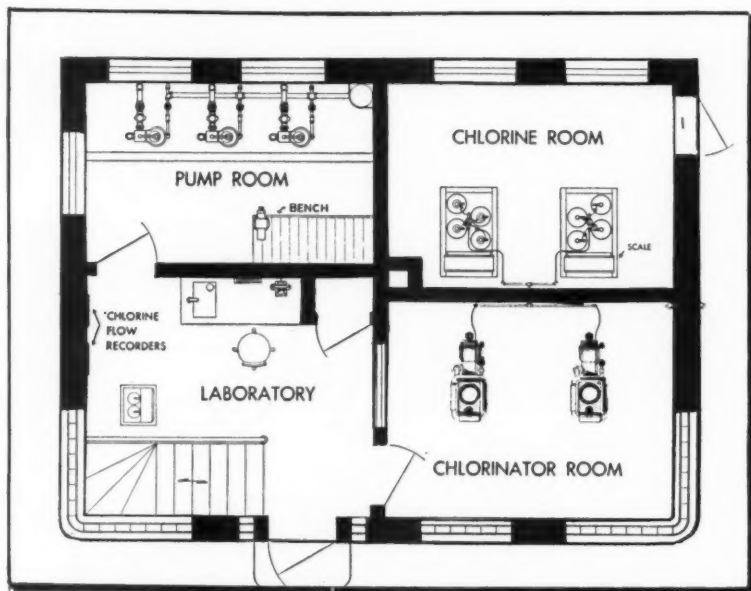
### Controlling $H_2S$ Production

Although the average citizen may feel chlorine is being used rather liberally in the sewage collection system to please his esthetic senses, the engineer in charge of the system has another and more compelling reason. He knows that if  $H_2S$  production is allowed to proceed without restriction, costly repair jobs will soon be in order because of the indirect action of  $H_2S$  on concrete.

$H_2S$ , as such, does not attack concrete directly. Upon being released from the sewage as a gas, a certain portion dissolves in the moisture clinging to the walls or in the moisture in the air. Here it obtains oxygen from the air and is converted slowly, first into sulphurous acid and finally into sulphuric acid. The sulphuric acid thus formed, in turn, attacks the concrete. When hydrogen sulphide formation is prevented, whether by chlorination or by other means, much has been accomplished as regards both odor annoyance control and deferment of repair costs. Thus, when chlorine is applied up-sewer for odor abatement, it does double duty.

To a minor degree, up-sewer chlorination tends to ensure the arrival at the plant of a fresher sewage. This may be of considerable importance because stale sewage is notably difficult to treat. Fresh sewage settles better; requires less oxygen for stabilization and in general handles better than stale sewage. Furthermore, such processes as activated sludge will not function at their best unless the quality of the sewage arriving at the plant is relatively constant. Chlorination in up-sewer locations ensures the arrival at the plant of sewage in such a condition that it can be economically and efficiently treated.

The amounts of chlorine required for such purposes will vary over a wide range and may be from 5.0 to



● **A WELL-ARRANGED operating building providing space for chlorine storage, the chlorinators, pump installations and laboratory.**

50.0 ppm. The greatest economies are obtained by the addition of chlorine at a point prior to the formation of  $H_2S$ . This is because fresh sewage has a lower chlorine demand than stale sewage. Furthermore, prevention is always more satisfactory than cure and is usually less costly. This suggests multiple points of up-sewer chlorination. Such a procedure usually requires less chlorine than one-point chlorination and, more importantly, is usually more effective.

### The Program Basis of Dosage

It is often desirable to add the chlorine in proportion to the flow. Otherwise, particularly in remote areas, either the cost of attendance will be unduly great or there will be periods of under or over-treatment. Over-treatment will not be deleterious except on the pocket-book, but under-treatment can be so frequent and so severe that most of

the usefulness of the chlorine will be nullified. Inasmuch as flow characteristics are sometimes difficult to obtain, particularly on the collection system, this condition can be met by placing chlorination on a program basis. This is a scheme whereby a timing device increases or decreases the dosage of chlorine at certain specified time intervals in accordance with a prearranged schedule complying with known variations in sewage strength and flow. This combined with the automatic adjustment of chlorination at the plant allows

for very economical and effective use of chlorine. Such a procedure has been used with much satisfaction at Fort Wayne, Indiana.

Straight pre-chlorination, which infers addition of chlorine near or at the point of sewage entrance to the plant, is used to control odors at and within the plant, preserve the freshness of the sewage through the plant, prevent septicity within the primary settling basins, aid in grease removal and obtain a reduction in coliform organisms.

The chlorine requirements again vary over wide ranges. In the case of a very fresh sewage containing no hydrogen sulphide and containing some dissolved oxygen, the dosage will usually lie between 5.0 ppm. and 10.0 ppm. However, should the arriving sewage be stale and septic, the dosage will seldom be less than 10.0 ppm. and may be as high as 30.0 ppm. or even more. During the warm months or in southern cli-

mates, the average chlorine requirements for the average sewage will be in the order of 15 to 18 ppm.

The chlorine may be added on a manual, a flow-controlled automatic, or a program-controlled basis. The manual basis has all the drawbacks of over and under treatment. Flow-controlled application is much better, but again does not take into consideration the changes in chlorine demand. Program-control superimposed on flow control will do a much better job with the ultimate being a true residual control.

### Maintaining Sewage Uniformity

Effective purification by the activated sludge process depends to a large degree upon the uniformity of the raw sewage. Such plants operate within definite biological limits. Relatively slight changes in acidity, freshness, or even strength of the sewage, frequently is all that is needed to upset this balance with attendant deterioration of the final effluent.

Among the various methods used for determining when these limits have been exceeded, the determination of the oxidation-reduction potential (ORP) is assuming an important place. Biological sewage treatment plants usually operate well so long as the potentials are on the oxidizing or positive side. Reducing potentials spell danger because, when reduction goes too far, hydrogen sulphite is produced, followed by septicity.

It is well known that when chlorine is added to sewage, the potential will soon assume a positive value. This can be read as millivolts. Chlorination has now progressed to the point where positive potentials can be maintained automatically. This is accomplished by means of a cell which is connected to a chlorinator through a series of relays. When the potential drops below a predetermined point, the impulse from the cell actuates the chlorinator which in turn applies more chlorine. When the control point is reached, the chlorine application levels off or its addition is stopped entirely. It is also so arranged that no residual to OT will be produced. The system is known as "potential chlorination" and has been in use at Fort Wayne, Indiana, for several years.

### Application to Treatment Units

Within the plant itself, there are many points where chlorine is used to excellent advantage. To rid the trickling filters of undue growths which have led to ponding, it is only

necessary to chlorinate the sewage in the dosing tanks. Sufficient chlorine to produce residuals of 20 to 50 ppm. at the spray-heads is usually necessary. Treatment periods are short so that the chlorine will not penetrate the beds too deeply. It is the surface growths that must be killed. Complete removal of the biological growths will stop the action of the filter and weeks may be required to get it back into condition. Incidental to such treatment, it is surprising how much grease will be removed from the piping. A manifestation of such a consequence may be plugging of the spray-heads. Inspections usually will reveal that the chlorine has loosened both slime and grease.

Activated sludge plants are subject to sludge bulking. Among the many remedies, chlorine holds a favored position. The trick is to know when to add chlorine and just as importantly when to stop. Smith, Tapelshay and Adams are among the leaders in this respect. Smith, with the aid of the U. S. Public Health Laboratories at Cincinnati, first called attention to the value of such a procedure while Tapelshay and Adams evolved formulas for maximum and consistent results. The total amount of chlorine used is relatively small, usually, only a few pounds per day per million gallons of treated sewage. The treatment is never carried to the point where a residual to orthotolidine appears. Chlorination at such a concentration might slow down the process because of the excessive kill of biological life in the sludge.

Supernatant liquor from digesters is very potent and troublesome. Its chlorine demand is usually very high (10,000 to 30,000 ppm.), and the BOD is so great that it is seldom measured. When returned to the primary settling tank, it can cause rapid formation of H<sub>2</sub>S and it can lower the oxygen-reduction potential (ORP) to the point where the functioning of the plant may be seriously affected. This is particularly true of activated sludge plants. Chlorination of this liquor will minimize these difficulties. The total poundage of chlorine used will be small even though the rate of application may be of the order of 30,000 ppm., or more. This is because the flow is small. At a few plants, chlorine is applied to the incoming raw sewage during the periods of supernatant return. Such practice, as indicated before, ensures continuous treatment with a minimum of upsets.

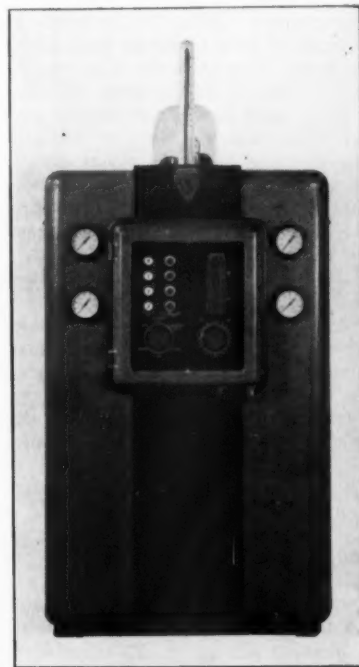
In those cases where iron salts are

used, experience has shown the best results are always obtained when a residual is maintained throughout the treatment plant. This is because the chlorine holds the iron used in a ferric state. In this state, iron is largely insoluble and good clarification results. If the iron is allowed to become reduced, that is, to drop from a ferric to a ferrous state, part of it tends to go into solution and part forms ferrous hydroxide, which is a poor coagulant. This tends toward the production of a cloudy or turbid effluent. Maintenance of a residual throughout the plant prevents such occurrences.

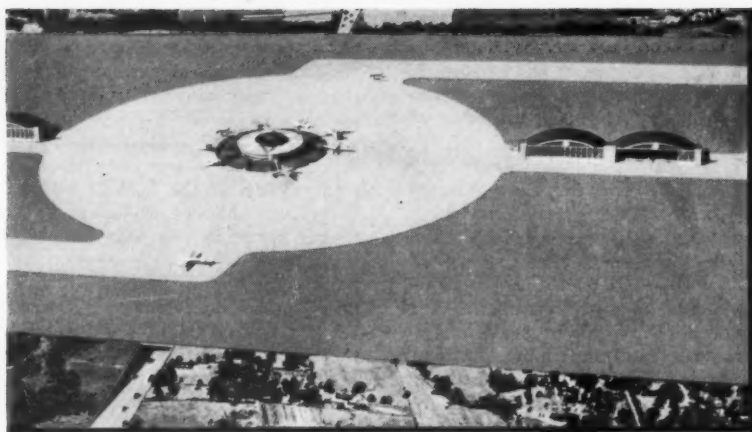
### Use in Imhoff Tanks

Excessive foaming in Imhoff tanks is usually the result of "wild" bacterial activity. Application of chlorine to the sewage entering such tanks, to produce an OT residual will usually slow down such activity and thus reduce the evolution of gas responsible for the foaming. Chlorination of elutriation water and clarified effluent used for irrigation will go far toward the control of odors which sometimes are a source of annoyance to inhabitants of nearby dwellings. Chlorination of clarified effluents used for wash-down purposes or even rechlorination of city water used for wash-down purposes will "sweeten up" any sewage treatment plant.

(Continued on page 48)



● PROGRAM CONTROLLED chlorinator for a sewage treatment plant.



# ECONOMY in

**EDWARD PAYSON HALL**  
Airport Design and Planning Consultant

## AIRPORT DESIGN

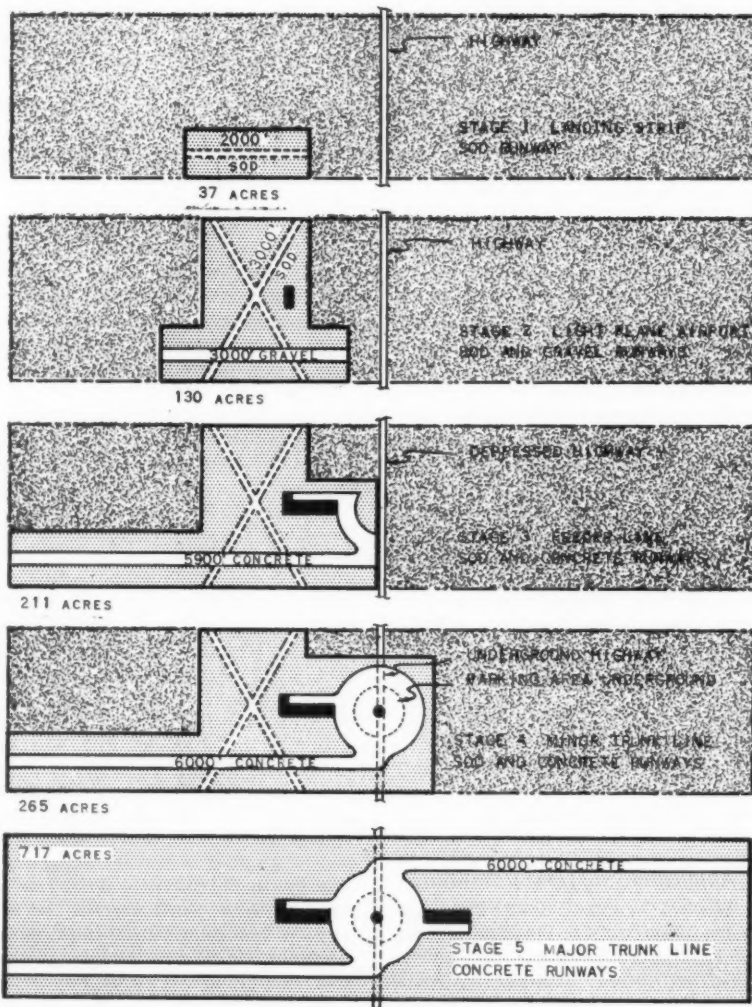
**R**ISING cost of airport construction, coupled with the serious financial losses suffered in recent years by the airlines, is cause for municipalities to re-examine their airport programs to determine whether they are realistic and are planned for future air transportation; or whether they are out-dated and planned to keep up with the airport over-expansion of a rival community. Municipal officials in charge of airport development bear a great responsibility both to the public and to the airlines, for it is within their power not only to prevent burdensome taxes on the citizens of the community but also to provide, for the airlines, reduced operating costs which will in turn be reflected in lower travelling costs to the public.

In view of the federal and state aid that is available to the community, rising costs of airport construction need not be a deterrent, provided each dollar invested is buying as much airport as can be obtained, and provided that the airport is designed and built to provide facilities that are not beyond the ability of the community's air traffic to support.

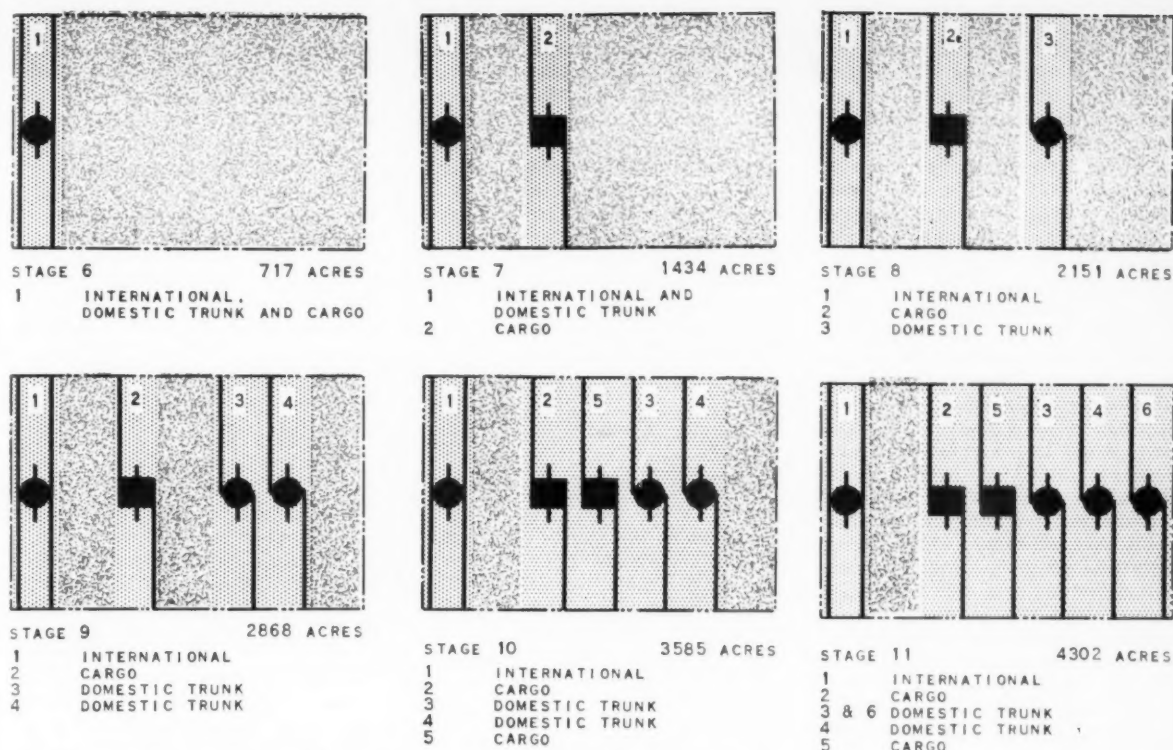
It is most essential, for economically sound airport development, to plan airport facilities which are expandable from current requirements to those which may be reasonably

expected in the future. Careful survey and analysis of the factors influencing airport usage should be made before a new airport is designed or built. By means of the survey, the future airport needs should be forecast in order to have an over-all general plan for ultimate development. The airport plan must be sufficiently flexible to permit expansion of facilities when traffic growth requires it without scrapping previous installations.

Typical expansion flexibility by means of the Unidirectional Runway Airport is shown in Figure 2 in the step-by-step development for a small community. Figure 3 shows development stages of the same type of airport for a large metropolitan district. The two figures together indicate a range of airport facilities from a single landing strip for light planes to a major terminus with



● **THE Unidirectional airport, above. Fig. 2, right, small community development plan.**



● FIG. 3. Seven stages in the step-by-step development of the Uni-directional airport for a large metropolitan district.

provisions for seven simultaneous landings and seven simultaneous take-offs during contact weather and eight simultaneous take-off and landing operations during instrument weather.

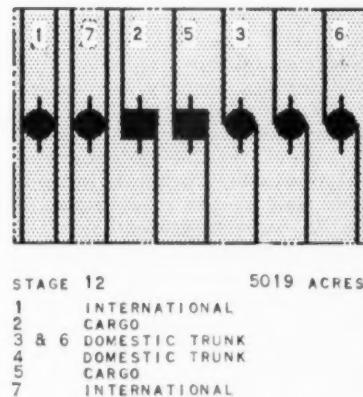
It should be pointed out that economy of operation is maintained even in the 12th development stage of Figure 3 in that each of the seven integrated airports is specifically adapted to handle a particular type of traffic. Thus customs and immigration facilities, provisions for operating and servicing long range aircraft and means for handling unusually large quantities of personal baggage that are common to international operation are designed and built into the airports set aside for this type of service.

#### The Most Airport for Each Dollar

Obtaining the most airport for each dollar invested is a matter of precisely fitting the airport to the prevailing weather conditions at the airport site. It can be shown irrefutably that in most sections of the country the modern transport airplane can land and take-off practically 100% of the time from a single runway provided the runway is properly oriented in relation to the high-velocity prevailing winds. For small volumes of air

traffic it is entirely practicable to use a single runway of adequate length. However, for larger volumes of traffic it is desirable to have two parallel runways adjoining the loading ramp as in the photo. Since landing and take-off operations can be carried on simultaneously, this airport is capable of handling 120 transport operations per hour. Though it can handle the traffic of a major city, this airport is very economical of land area, requiring only 717 acres for dual runways 6,000 feet long, both of which can be extended to 12,000 feet, if the need arises, without further increase in land area.

Unfortunately, most of the major cities in the United States have airports that were designed and built long before the evolution of the modern transport airplane and before a thorough understanding of the design problem was available. Investment in these airports is staggering, even by today's monetary standards, but the airports are not entirely adequate to handle even present-day air traffic, to say nothing of traffic to be expected in the near future. For example, ten major cities in the northeastern section of the country, originating 40% of the total number of passengers flown in Fiscal Year 1948, have



NOTE: AIRPORTS 1, 2, 3 AND 6 HAVE INSTRUMENT RUNWAYS; AIRPORTS 4, 5 AND 7 HAVE NON-INSTRUMENT RUNWAYS.

airports with average aggregate runway lengths of 24,000 feet exclusive of taxiways and aprons. Yet six of the ten cities have airports whose longest runways are less than 6,000 feet when reduced to equivalent sea-level length! Only one of the thirteen airports serving the ten cities has an emergency landing area beyond the end of the landing runway!

#### Annual Costs are the Criteria

Initial cost cannot be used as the yardstick of economy: annual cost is the criterion that must be ap-

plied. A million dollar investment in an airport that is obsolete in ten years is a more expensive investment than two million dollars invested in an airport that is properly designed and still adequate 25 years after its completion. Reduction to an annual cost basis is also necessary to evaluate properly other phases of airport planning and design problems.

To reduce costs to an annual basis it is necessary to assume a useful life for the airport. Although a well-designed airport can be expected to have an increasingly useful life for well over 25 years, the assumption of a 25-year amortization period is conservative in that a longer period would reduce the annual cost of amortizing the initial investment. Assuming further that municipal tax-supported bonds can be marketed at 2% and the bonds will be retired with five equal payments at five year intervals, the annual cost will be \$53 per \$1,000 invested by the community. Inasmuch as the Federal Government will, under most conditions, match the investment of the community, \$1,000 worth of airport will cost the community only \$26.50 annually.

Figure 4 shows the approximate total initial investment for the various development stages of the Unidirectional Runway Airport exclusive of terminal building and hangar construction. By way of comparison, the average total airport investment<sup>1</sup>, exclusive of terminal and hangar construction, of the 13 airports serving the ten largest northeastern cities is included. It is doubtful if the largest of the 13 airports can handle as much traffic as development stage 6 of the Unidirectional Runway Airport. Approximate yearly amortization cost to the community for the various development stages of the Unidirectional Runway Airport is shown in Figure 4. The values shown assume that half of the initial investment has been borne by the Federal Government.

#### What Costs Include

Airport costs must take into account the ultimate cost to the public not only of the airport itself but also the cost of airport usage.

A recent study<sup>2</sup> conducted by the CAA shows that 95% of the total enplaned airline passengers for the Fiscal Year 1948 (12,496,614) were originated in cities and metropolitan areas comprising 50% of the total United States population (1940 Census: 131,670,000). The study also forecasts an increase in the number of

passengers by 1955 of 1.6 times the number of passengers in 1948. These data provide the means of arriving at a general, over-all annual average number of passengers enplaned per capita of 0.286, or 0.572 enplaned and deplaned passengers per capita per year. This figure, when applied to the next 25 years is, in general, conservative in that it does not allow for further inevitable per capita increase in the number of passengers beyond 1955.

Average limousine rates to airports for the major airlines are 11.8 cents per passenger mile. Applying the factor of 0.572 enplaned and deplaned passengers per capita per year to a community of 200,000 population, each mile from the airport to the city will cost the flying public of the community \$13,500 annually in limousine fares alone. Stated in another way, if a city of 200,000 population were considering two airport sites, one of which was three miles closer to the city, the close-in airport site would be worth about \$40,500 more to the city annually than the outlying site, other factors being equal. Compare this sum with the approximate annual cost of investment of the community for various stages of airport development (Figure 4).

In a previous article (this magazine, January, 1949) it was shown that a total of 4 minutes could be saved on each airline stop by completely segregating landing and take-off operations and by having the landing runway terminate and the take-off runway start as near as practicable to the terminal building. Translating these four minutes saved into dollars, the flying citizens of a community of 200,000

population would save about \$16,900 annually in reduced airline fares if all airports of the airline route were designed to save the same four minutes!

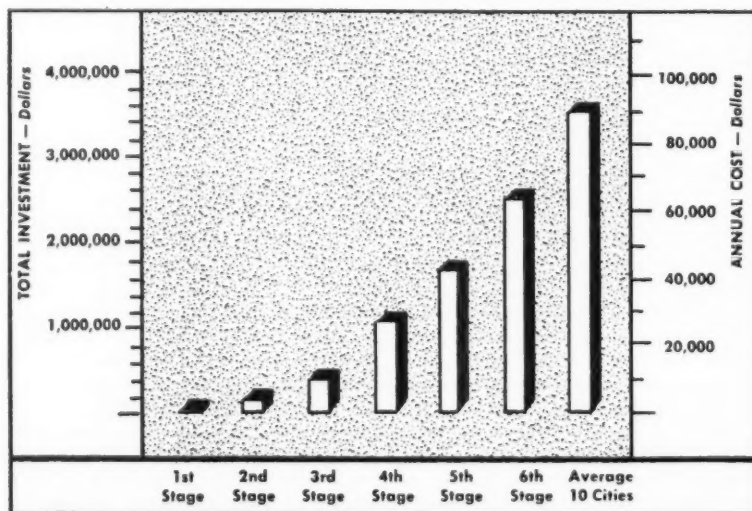
Also in the previous article it was pointed out that a single airport with inadequate runway length could cost an airline the loss of 8,300,000 passenger miles annually for a single round trip per day. At an average rate of 5 cents per passenger mile this amounts to a potential loss of revenue of \$415,000 annually.

Of the examples cited above, two were based upon a community with a population of 200,000 and the loss to the public would be more or less for any other community depending upon whether or not the population were greater or less than the figure used. In the other example, the loss is based upon the number of round trips per day and the loss would, of course, be greater for a greater number of daily flights. In any event, whether the particular community be large or whether it be small, proper consideration of the planning and design problem can result in direct and indirect savings to the community that can equal or exceed the annual cost of the community's investment in the airport.

It is rarely true that better service can be obtained at lower cost; yet this is true in the case of the airlines through careful airport planning and design. The day of guessing in airport design is past; the technical tools and know-how are available.

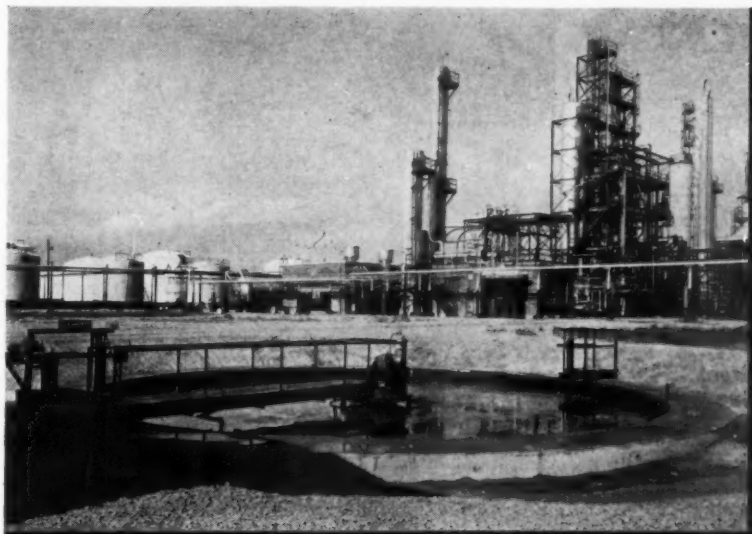
(1) *New York International Airport, being atypical, is not included in the average.*

(2) *Airport Planning—Airline Passengers, CAA, December, 1948.*



● FIG. 4. Annual costs for various stages of airport development.

# INDUSTRIAL WASTE DATA



Courtesy Dorr Co.

## DATA

WASTE TREATMENT for an oil refinery recovers oil for use and produces an effluent virtually free from oil constituents. The treatment is carried out in two stages—removal of floatable oil, and flocculation of emulsions with a chemical, followed by sedimentation.

**A**BATEMENT of industrial waste pollution does not always or necessarily involve treatment procedures. However, it is generally desirable to have information on the strength and volume of the wastes that are produced, even though these data apply to the industry as a whole, and must be applied with caution to the individual plant. It is also desirable to obtain complete information on every plant, before making plans for waste treatment, with a view toward employing such methods as elimination, reduction or change in character of the wastes; segregation of objectionable components; or separation of clean water. In making such a study, Weston, Merman and DeMann (Sew. Wks. Jnl., March, 1949) recommend (1) an evaluation of the wastes and the receiving streams; (2) study of plant layout and existing facilities; (3) investigation of applicability and economy of possible abatement methods.

This article is generally limited to the presentation of data on a number of industrial wastes, the data covering, where such information is available or applicable, the following factors: (1) Volume of wastes per standard unit of production; (2) general character of the wastes produced; (3) BOD and population equivalents of wastes; (4) a brief statement of the methods of treatment reported to have been found applicable; (5) the effects of the discharge of such wastes into municipal sewer systems and treatment

plants; and (6) reasonable standards for the treated waste to permit discharge into watercourses.

The data herein are taken from many sources. The report of the Public Health Service on its study of industrial wastes in the Ohio River basin has been used as the basis for the great bulk of the information. Where other sources have been used, references are given in the text.

In order to avoid needless repetition of terms, the following condensations will be used: BOD for 5-day biochemical oxygen demand; TS for total solids; SS for suspended solids; and PE for population equivalent. Unless otherwise stated, all numerical values are in parts per million, and all values are approximate and represent average or overall figures. Also, references are as follows: SWJ for Sewage Works Journal, SWE for Sewage Works Engineering; WSW for Water and Sewage Works, etc.

### Brewery Wastes

The unit of production is the barrel of 31 gallons. The waste flow per unit averages 300 gallons. Strength of waste depends on the handling of the spent grain. If the yeast and water are extracted from it, BOD will be about 1200 and SS 650. If the grain is sold wet, as is done by many small plants, BOD of the fac-

tory waste will be about 800 and SS 450. PE per barrel of beer produced daily will be: Where the grain is dewatered, 19; where it is sold wet, 12. There will be about 0.25 employee per barrel of daily production.

Polluting effects of brewery wastes are almost entirely due to their oxygen demand.

Treatment on trickling filters has been effective. Chemical treatment may give good results, but chemical costs may be high. At Houston, primary settling, 1.5 hours detention, reduced BOD about 18%; two trickling filters, with a loading of 575 lbs./acre-foot, gave reductions as high as 90% when operated in series; less when operated in parallel.

Disposal into municipal sewers requires additional capacity in the municipal treatment plant but otherwise does not appear to affect treatment.

### Canning

Canning plant wastes vary with the product. Unit of production is the number of cases of No. 2 cans produced daily, with 24 cans in each case. Volume of flow per case, BOD, SS and PE average as follows:

Asparagus—70 gals.; BOD 100; SS 30; PE 0.35.

Pork & Beans—35 gals.; BOD 925; SS 225; PE 1.6.

Green Beans—35 gals.; BOD 200; SS 60; PE 0.35.

Lima Beans—250 gals.; BOD 190; SS 420; PE 2.4.



Courtesy Ralph B. Carter Co.

● **FLOCCULATING and settling tanks treat 250,000 gpd of wool, yarn scouring and dyeing wastes.**

Beets—37 gals.; BOD 2,600; SS 1,530; PE 4.8.

Cream Style Corn—25 gals.; BOD 620, SS 300; PE 0.75.

Whole Kernel Corn—25 gals.; BOD 2,000; SS 1,250; PE 2.5.

Peas—25 gals.; BOD 1,700; SS 400; PE 2.1.

Pumpkin and Squash—(No. 2½ cans) 25 gals.; BOD 6,400; SS 1,850; PE 8.0.

Sauerkraut—3 gals.; BOD 6,300; SS 630; PE 1.0.

Spinach—160 gals.; BOD 615; SS no data; PE 4.9.

Succotash—125 gals.; BOD 525; SS 250; PE 3.3.

Tomatoes (whole)—7½ gals.; BOD 4,000; SS 250; PE 1.5.

Tomato Products—70 gals.; BOD 1,000; SS 2,000; PE 3.5.

Grapefruit Sections—56 gals.; BOD 1,850; SS 270; PE 4.8.

Apricots—80 gals.; BOD 1,020; PE 4.1. Can size and SS not given.

Pears and Peaches—65 gals.; BOD 1,340; PE 4.4; Can size and SS not given.

Fine screens, about 40-mesh, should be used to remove coarser solids. Lagooning has been effective, when volume of storage is sufficient to provide for the season's run, which is usually short; sodium nitrate has been helpful. Chemical coagulation produces BOD reductions up to about 50%. Activated sludge and trickling filters have been used effectively, but the short season is an unfavorable factor, as these processes require time to build up to maximum efficiency.

Municipal treatment plants can handle a reasonable excess loading of canning wastes. The Ladysmith, Wisc., plant is designed to treat domestic sewage from 4,000, plus pea and bean canning and milk process-

ing wastes. Treatment consists of coarse screening, maceration, high capacity filter using tile media, and settling. Filter loading is 3.3 lbs./cu. yd. (SWJ, March, 1948). At Geneva, N. Y. (Marshall, SWJ, March, 1947) beet wastes equivalent to 33,000 population (plant designed for 24,000 and treating wastes from 20,300) caused red color in effluent and increased gas production 29%.

#### Distillery Wastes

The unit of production for grain liquors may be 1,000 bushels of grain mashed, or the equivalent 5,000 gallons of 100-proof spirits, produced daily. For molasses distilling the unit of production is 1,000 gals./day of 100 proof liquor. The combined wastes from distilling grain will amount to about 600,000 gals. per unit of production. Molasses distilling produces 8,400 gals. of waste per 1,000 gallons of 100-proof liquor, plus 120,000 gallons of cooling water. Employees average 8 per 1,000 gallons of liquor produced daily, whether from grain or molasses.

The thin slop from a grain distillery may have a BOD of 34,000 ppm, and a PE of 55,000 per 1000 bushels of grain mashed. Other wastes are: Tailings, BOD 740 and PE 50; evaporator condensate, BOD 1200 and PE 1500; other combined wastes, PE 3500. In a molasses distillery, the BOD of the molasses slop is about 33,000 and PE 12,000 per 1000 gals. of 100-proof liquor. (Note that grain distillery on basis of same liquor production would have PE of 11,000.)

The production of alcohol by fermentation of corn, rye and malt for whiskey, and of molasses or cane sirup for rum or industrial alcohol, produces highly organic wastes, with

a major portion of the solids in solution.

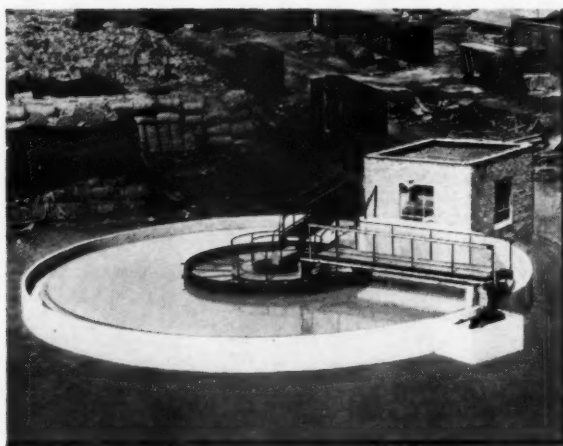
Much water is used for cooling. Thin slop waste does not generally exceed 25 to 35 gals. per bushel of grain (5 to 7 gals. per gal. of liquor). In a molasses distillery, the slop amounts to 8 to 10 gals. per gallon of liquor. Thin slop from a grain distillery may have a pH as low as 3.7, a chlorine demand of more than 500, TS nearly 50,000, of which 90% are volatile solids.

Pollution effects arise principally from the high BOD. Lagooning results in odor and fly-breeding. Irrigation requires frequent cultivation and one acre is required for each 10,000 gallons of slop produced per day. Digestion and thickening have been used with some success; the digester effluent has been treated on trickling filters after dilution with 5 parts of filter effluent; rate was 0.25 mgd of filter effluent or 1.5 mgd per acre total.

At MIT, Sedgwick Laboratories treated sewage combined with 1% distillery waste on high rate filters. BOD of raw was 485; loading on filter, 2,590 lbs./af.; recirculation 3 to 1; final effluent BOD 19.7; removal 95.7%.

#### Oil Wastes

Waste flows from oil refineries average 700 to 800 gals. per barrel of oil processed. If the water is not reused, cooling water accounts for 80% to 90% of the volume. BOD is from 10 to 30; SS about 50. Lacking full data PE may be assumed as 60 per 1,000 bbls. of oil processed. Waste contains free and emulsified oil which forms films on water surfaces, coats objects with which it comes into contact, retards atmospheric aeration, causes taste and odor in the



Courtesy Inflico Inc.

● **A CYCLATOR installation to treat paper wastes at the River Raisin Paper Co., Monroe, Mich.**

water, and may form sludge deposits. Maximum separation at the refinery is desirable. Caustic wastes, mineral acidity and phenol content may require corrective treatment. Brines are common problem in oilfields. If they contain carbonates and iron, these must be removed before discharge into underground formations to prevent clogging. Removal is usually by sedimentation and filtration.

### Cotton Textiles

The unit of daily production is 1000 lbs. of goods. For various cotton textile processes, volume of wastes, BOD and PE are:

Process	Gals./1000		
	lbs.	BOD	PE
Sizing .....	60	820	2.4
Desizing .....	1,100	1,750	96
Kiering .....	1,700	1,240	105
Bleaching .....	1,200	300	18
Souring .....	3,400	72	12
Mercerizing ...	30,000	55	83
Dyeing			
Direct .....	6,400	220	71
Basic .....	18,000	100	90
Vat .....	19,000	140	130
Sulfur .....	5,400	1,300	347
Developed ..	14,400	110	120
Naphthol ...	4,800	250	60
Aniline Black	15,600	55	43

Composite wastes from cotton mills may be assumed to have a

ards are: Color, not more than 100; pH 6 to 8; SS, TS and BOD as for domestic sewage.

At Dallas, Pa. (SWE, Mch., 1949), Zack reported, wastes produced by bleaching, souring, rinsing, dyeing, sizing and finishing had a BOD of 700. A reduction of 70% was obtained by chemical coagulation, using lime, copperas, alum or ferric chloride; 20 days ponding reduced BOD to 10; SS to 20.

### Laundry

Volume of laundry wastes per 100 pounds of dry wash is 350 to 500 gals.; BOD 1,000 to 1,500; SS 400 to 600; grease 400 to 500; PE 20 to 25. The waste is alkaline and highly turbid. It forms sludge banks and scum and causes turbidity in a stream. Treatment may be by chemical precipitation which produces sludge having a volume around 10% of the raw waste. Trickling filters and activated sludge have been used successfully. Except in excessive amount, laundry wastes do not interfere with municipal treatment plants.

### Milk and Creamery

Volume and strength of milk wastes per 100 lbs. of milk intake daily is approximately: Receiving station, 175 gals., BOD 500; PE 4. Bottling plant, 250 gals., PE 6. Cheese factory, 200 gals.; BOD 1,000; PE 10. Creamery, 110 gals.; BOD 1,250; PE

may accomplish a reduction of 30% in BOD. Anaerobic stabilization in a digestion tank has been reported favorably; this must be followed by filtration. Sand filters 4 ft. deep, preceded by a septic tank with 48 hours detention, dosed at rate of 50,000 gals./acre/day were used; no results were reported. Trickling filters are reported to give 80% to 90% reduction. Loadings are not well standardized but may be in the range of 1.3 to 2 lbs./cu.yd./day. With suitable air volumes and contact periods, activated sludge gives favorable results, with removals to 90% or more. Average effluent BOD at one plant using activated sludge (Eldridge, SWJ, July, 1949) for July, 1948, was 11 ppm; influent 936 ppm.

For treating strong milk, canning and meat processing wastes, Banister and Ellison (PW, Sept., 1947) recommend a self-cleaning 10-mesh screen, a high rate filter with tile media, and settling. To produce effluents below 50 ppm of BOD, a second stage filter is necessary.

### Paper

Wastes from pulping mills, per ton of product daily, are as follows: Ground wood, 5,000 gals.; BOD 645; PE 160. Soda pulping, 85,000 gals.; BOD 110; PE 460. Sulfate or Kraft pulping, 64,000 gals.; BOD 125; PE 390. Sulfite pulp, 60,000 gals.; BOD 450; PE 1,330.

Wastes from paper mills per ton of paper produced daily are: Paper, miscellaneous, no bleach, 39,000 gals.; BOD 19; PE 36. Paper, miscellaneous, with bleach, 47,000 gals.; BOD 24; PE 56. Paperboard, 14,000 gals.; BOD 121; PE 84. Strawboard, 26,000 gals.; BOD 695; PE 900. Deinking waste paper, 83,000 gals.; BOD 300; PE 1,250.

Digester liquors are the most objectionable waste produced in any large quantity. BOD is high; so is color; and the wastes may cause serious odors.

Savealls and recirculation are essential to reduce the strength of the waste. Much experimental work is being done on treatment. Chemical treatment has been reported to reduce BOD as much as 65%. Ponding is reported on favorably, using 60 days storage.

Buswell and Sollo (SWJ, July, 1948) report the successful use of methane fermentation on paperboard wastes. About 100 ppm of nitrogen as ammonia was added, resulting in 90% reduction in BOD. They state that at this plant, production of 390 tons of wood pulp resulted in 92,000 lbs. of dry solids and 64,700 pounds of BOD per day.

A plant of Congoleum-Nairn, Ce-



Courtesy American Well Works

● SEWAGE with much laundry waste is treated in this Bio-Activation plant, combining filtration and activated sludge.

population equivalent of 20 per 1000 gals. of waste.

Remedial measures include recovery, reduction of waste in plant, equalization of flow and mixing of the various wastes. Chemical treatment, with iron and aluminum salts, requires large amounts of chemicals, some of which can be recovered. Sludge is voluminous, but dries fairly readily. Activated sludge has been used successfully and is effective in removing color when the wastes are mixed with domestic sewage. Trickling filters give good treatment, but color removal may not be high.

When discharged into municipal sewers, holding tank capacity of 24 hrs. is necessary, and sometimes pH adjustment. Proposed disposal stand-

7. Condensing plant, 150 gals.; BOD 1,300; PE 10. Dry milk plant, 150 gals.; BOD 480; PE 3.6. General dairy, 340 gals.; BOD 570; PE 10. Wastes result from rinsing, washing and spillage, in addition to process wastes from butter, cheese, casein, etc. Spillage is an important part.

Effects of pollution are almost wholly due to the oxygen demand of the wastes. Fresh wastes may be either acid or alkaline. On decomposition, wastes are acid; black sludge deposits and strong odors result.

Irrigation may be applicable to small plants; sandy soil is required, with constant cultivation. Odors must be controlled with lime or hypochlorite. Settling in Imhoff tanks has not been satisfactory. Use of septic tanks

darhurst, Md., used 3 basins, total capacity one week's flow; effluent BOD was 2,000. This is diluted with 5 times its volume of final filter effluent and applied to a primary, then to a secondary filter and secondary settling tank. Results not given.

Eight strawboard mills in the mid-west were sampled (Bloodgood & Erganian, SWJ, Nov. 1947). These averaged 3,835 ppm TS; 1,707 SS; and 847 ppm BOD. Values of BOD ranged from 525 to 980. From 50% to 60% of SS can be removed by settling for 1 hour. Of the BOD 47% was in a dissolved state. BOD reduction in mixture of sewage and strawboard waste is more rapid than in either one alone.

Holderby (SWJ, July, 1946) reports laboratory scale trickling filter removed 75% of the BOD of sulfite wastes in loadings in excess of 6 lbs./cu. yd.

Crawford (SWJ, July, 1947) reports a paper mill in Virginia discharged the "most polluting" wastes to a pond. During a 4-month ponding period, BOD decreased 21.8%; pH dropped from about 11 to about 8.5; and SS decreased 81.1%.

### Meat Packing

The unit of production is one hog processed daily. Cattle are equal to 2½ hog units; hogs, calves and lambs are one hog unit each. Average waste volume and strength per hog unit are: Packing plants, 550 gals.; BOD 900; PE 24. Slaughterhouse wastes, 150 gals.; BOD 2,200; PE 17. Stockyards, per acre of area, 25,000 gals. per day; BOD 65; PE 80. Processing of poultry, per 1,000 lbs. live weight, 2,200 gals.; PE 300.

Meat plant wastes are generally similar to domestic sewage in their effects on streams, but danger from pathogenic organisms is small. Oxygen depletion, sludge deposits and discoloration are common results.

Sedimentation is helpful and may reduce BOD by 35% and SS by 65%, with detentions of 1 to 3 hours.



Courtesy Yeomans

● **MEAT PACKING wastes are treated in this disc-type Aero-Filter.**

Chemicals give additional removals but may produce a sludge that is difficult to treat. Ferric chloride and alum, used as coagulants, have given reductions of 80% or more BOD, but the settled effluent is rarely below 150 to 200 BOD. Activated sludge and filtration, both low and high rate, have been effective in BOD reduction. Mixing with carbohydrate wastes before such treatment is recommended by Nelson (SWE, Aug., 1949).

Treatment in municipal plants is entirely possible, provision being made to care for the increased loading. Where the meat plant wastes constitute a considerable proportion of the flow to the municipal plant, regulation to produce a uniform rate of flow of the waste may be necessary and almost always will be desirable.

### Tannery

The unit of daily production is 100 lbs. of raw hides, which will produce about 68 pounds of finished leather. Per unit of daily production, wastes will amount to about 800 gals.; BOD will be about 1,200; and PE 48 for vegetable tanning and 24 for chrome tanning. Wastes are usually highly alkaline, high in SS and strongly colored.

Pollutional effects include oxygen depletion, formation of sludge deposits, and a strong and persistent color. The intermittent nature of the discharge may accentuate the problem of pollution.

Untreated tannery wastes may deposit solids in municipal sewers and also form calcium carbonate scale. Caustic alkalinity and/or chrome salts may interfere with municipal treatment, if the proportion of waste to sewage is high. Regulation of discharge is desirable.

Mixing of the wastes and settling for periods up to 24 hrs. has removed 40 to 50% of the BOD and 70 to 80% of SS. Chemical precipitation has not been efficient. Intermittent sand or cinder filters are reported efficient in BOD and color removal. Trickling filters have reduced BOD 65 to 75% and color 15 to 70%; no data are reported on the use of high rate filters. Sludge disposal is a problem in that sludge volume is 7 to 10% of the waste volume. Drying on beds is slow.

### Coke

Waste per ton of coal carbonized by by-product coke plants averages 3,600 gals.; BOD 85; PE 15; phenol content 20 ppm. About 8 employees are required per ton of coke produced. Presence of phenols may cause highly disagreeable tastes in

chlorinated waters, even when the phenol content is very small. Pollution reduction is largely within the plant. Oxygen requirements can be reduced 30% by reuse of some of the liquids. Phenols can be recovered, but without profit; also, phenols may be oxidized by trickling or sand filters or activated sludge, if the concentration is not too great—30 or possibly 40 ppm. Biological treatment requires large plants and hence has not generally been economical.

### Wool Scouring

Unit of daily production is 100 lbs. of wool processed. Four plants in Massachusetts (McCarthy, SWJ, Jan., 1949) showed average of 126 gals. of wastes per 100 lbs. of wool processed; BOD 9,300; SS 7,300; pH 9.1. Alkalinity, m.o., 6,700; p, 1,300. Calcium chloride was used for floc formation, resulting in good settling; BOD reduction to 54%. Coburn; (SWJ, Jan., 1949) reports on same treatment process and states sludge is voluminous and difficult to handle.

### Soft Drink Bottling

For each 100 cases of bottled product, waste volume is 1,500 gals., having BOD of 150, TS of 700, SS of 20 and PE of 11. The sugar content tends to deplete stream oxygen. Trickling filters have been used successfully, both low and high rate. These data are from Interstate Commission on Potomac River Basin.

### Chemical Wastes

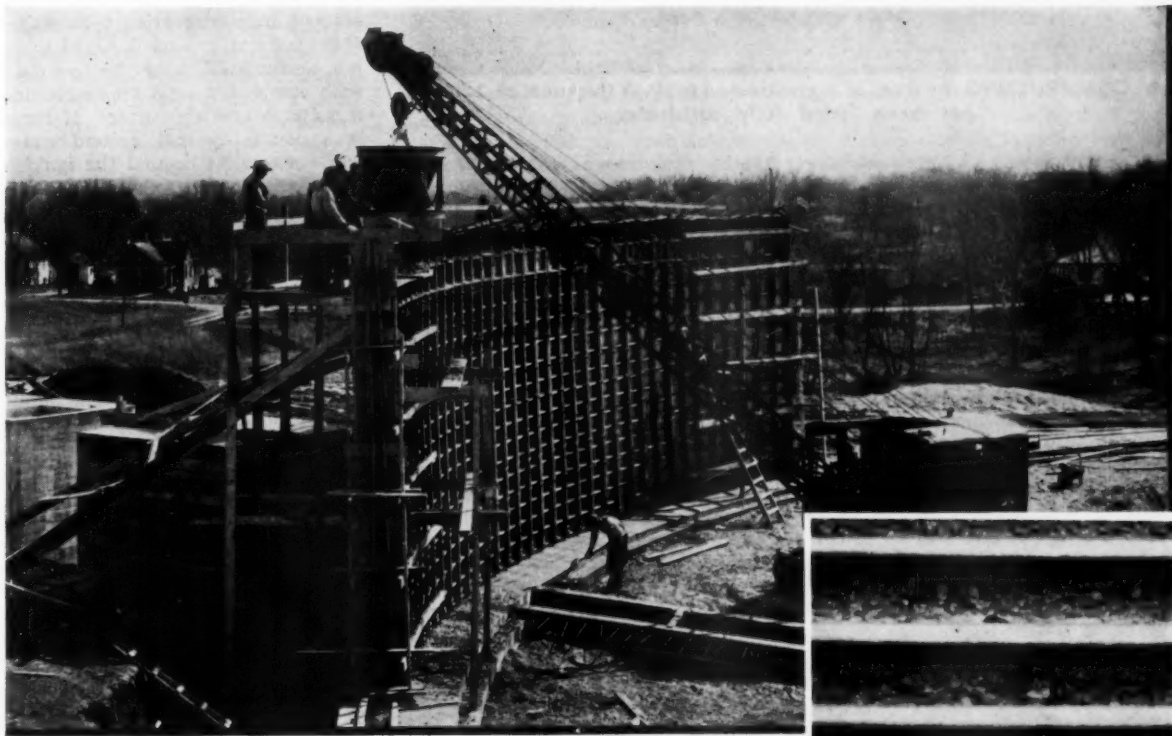
Wastes from synthetic resins, totaling 2,000 lbs. per day, were treated on high rate filters (Dickerson, SWJ, July, 1949). Sedimentation periods of 15 minutes seemed adequate; filter application rate was 50 mgad, with 40:1 recycle. Overall removal was around 96%. Filter loading not given.

### American Public Works Association

The 53rd annual meeting of the American Public Works Association was held in Kansas City, Mo., Sept. 18 to 21. W. O. Jones, city manager of Fort Worth, Texas, was elected president. Two of four vice-presidents were also elected, W. S. Foster, New York, and Carl Froerer, Alameda, Calif. Allan H. Rogers of Garden City, N. Y. was elected treasurer. Directors elected were: G. R. Thompson, Detroit; E. J. Cleary, Cincinnati; and Sol Ellenson, Newport News, Va.

# DESIGN CONSTRUCTION AND USES OF PRESTRESSED CONCRETE TANKS

*In order that our readers may know more about this development in concrete construction, we asked Mr. Dobell to outline important elements in design and use.*



## CURZON DOBELL

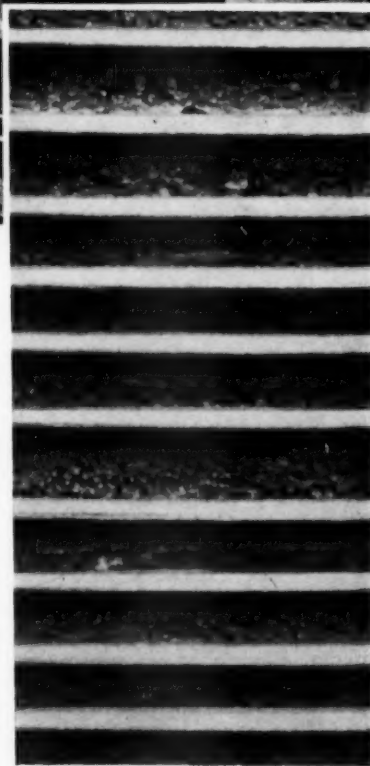
Vice President, Preload Enterprises, Inc.

**A**DVANTAGES of prestressed concrete as a building material—its strength, its economy and its ability to withstand heavy loads without cracking—are currently attracting intense interest among engineers throughout the world.

The pioneer work in using this material for linear members such as beams and girders for buildings and bridges has been done by European engineers, notably Professor Gustave Magnel of Belgium and Eugene Freyssinet of France. This was a natural development, because shortages of steel and concrete have always been far more critical overseas than they have in the Americas.

On the other hand, the research and development which has led to the use of prestressed concrete in circular structures, such as tanks, clarifiers, sludge digestion tanks, silos and large diameter pressure pipe, has been done almost exclusively in the United States. Because of the present interest in this phase of prestressing, the number of important prestressed circular structures which have already been erected, and the possibilities which remain to be exploited in this field, it is of interest to examine it in some detail from the aspects of design, construction procedure and usefulness.

● **HIGH-STRENGTH** wire used for reinforcing shown actual size.





● **CONSTRUCTING the floor of a prestressed tank. A thickness of 2 inches has been found fully satisfactory.**

The first attempt to prestress circular concrete structures was made in the United States by William S. Hewett, who, during the early twenties, developed methods of stressing reinforcing bars around tanks to offset the tensile stresses which the walls would have to carry under load. Unfortunately, since his designs made no allowance for shrinkage and plastic flow, many of these early prestressed tanks were unsuccessful. In 1933, John M. Crom, an American engineer who was familiar with European research in the field of prestressed concrete, initiated a program of research, in collaboration with the Massachusetts Institute of Technology and other scientific institutions, to evolve practical methods through which shrinkage and plastic flow of concrete and steel could be evaluated and compensated for in the design of circular structures. These investigations were reported in the *Journal of the American Concrete Institute* and in other leading engineering publications.

This research disclosed, among other findings, that to maintain the walls of a concrete tank in permanent compression, it is essential to include in the reinforcing steel a minimum excess of 35,000 psi to absorb subsequent stress losses due to shrinkage and plastic flow, in addition to the stress required to meet design loads. This surplus stress of 35,000 psi is a constant, representing a minimum factor of safety against tension cracking.

High strength steel rods have a minimum yield point of 70,000 psi and can be safely stressed to 50,000 psi. After deducting the aforementioned constant of 35,000 psi, only 15,000 psi remains for working purposes.

This means that with rods only 30 per cent of the strength of the steel is available to carry design loads, which is obviously not practical or economical.

#### Using High Strength Wire

Accordingly, our engineers developed methods for using special high strength wire for both the circumferential and vertical prestressing of tank walls. This wire has a minimum yield point of 175,000 psi and can be safely stressed to 140,000 psi, which after deducting the constant, leaves a working stress of 105,000 psi, or 75 per cent of its safe strength. As the tonnage of reinforcement for tank walls depends on the available working stress, it will be seen that high strength wire requires only 15,000/105,000, or 1/7 of the tonnage of steel needed for rod reinforcing.

The use of this high strength wire makes possible important economies in the use of steel and concrete. For prestressed tanks as compared with those designed in conventional reinforced concrete the savings in steel and concrete are respectively 75 and 85 per cent and 25 to 50 per cent. A typical example of these savings in materials is shown in the following table, prepared by the Engineering Department of the City of Philadelphia, which sets down the respective quantities of steel and concrete required for the eight 2,250,000 gallon sludge digestion tanks constructed by The Preload Corporation in 1948 at the North East Treatment Works.

Item	Preload Design	Conventional Design
Concrete (c. y.)	7,240	14,160
Reinforcement (lbs.)	551,200	2,360,000

With most concrete structures, it is necessary for the floor to be thick, so that it will be able to distribute concentrated loads. This is not the case with tanks, since the liquid load is distributed uniformly over the floor area. As there are no local loads, the only requirements for the tank floor are that it be watertight and possess sufficient flexibility to deform with moderate settlement in the sub-base.

For this reason, before beginning design or construction of any tank, particular attention must be paid to the sub-base on which it will rest. The ground should be carefully examined and soil bearing tests made. If the natural ground is found to be non-uniform, it may be overlaid with compacted sand fill to provide a uniform bearing surface. If there is a possibility that ground water will accumulate around the tank in sufficient amounts to cause hydraulic uplift at the bottom of the floor, a ring of drain pipes, of sufficient diameter to carry away all ground water, should be installed around the tank. The pipe is laid about 6 inches from the outside edge of the floor, in a trench deep enough for the top of the pipe to be even with the bottom of the floor. The joints are wrapped with burlap, and, after the pipe has been laid, the trench is back-filled with gravel or crushed stone. The pipe ring is connected to a discharge line leading to a suitable outfall.

Experience has shown that the most reliable floor for large or small tanks—the floor least likely to leak or crack under settlement—consists of 2 inches of monolithic pneumatic mortar reinforced with 0.5 per cent of steel in each direction. Such a floor has sufficient flexibility to conform to movements caused by frost or moderate settlement, with more than adequate protection against leakage even under high heads of liquid. With a 2" floor, the troublesome expansion joints necessary with heavier concrete floors can be dispensed with. Where a poured floor is used, 4-inch concrete is also satisfactory, when no appreciable settlement is anticipated, always providing the same percentage of reinforcement is used. After pouring or shooting, floors are left moist until wall construction has been completed to minimize the shrinkage differential between the walls and floors.

#### Wall Construction

The walls for Preload tanks may be built of either concrete or pneumatic mortar. It is usually more eco-

nomical to use pneumatic mortar when the walls are less than 6 inches thick; concrete when they are thicker. In either case, the wall forms are designed and erected in accordance with standard construction practice. After the walls have been shot or poured, they are allowed to cure for at least 7 days before the high tensile strength steel wire reinforcement is applied.

The joints between the walls and floors of Preload tanks may be free or fixed. It has been usual practice, with structures less than 100 feet in diameter, to tie the walls and the floor rigidly together by means of dowels, since the moments thereby created in the walls are readily absorbed by the vertical prestressing operation. With larger tanks, a modified form of sliding joint is generally used. The wall is permitted to slide inward during the horizontal prestressing operation and is then keyed in position so as to act as a hinged joint in service. Both types of joint can be made bottle tight.

The walls are reinforced horizontally by a self-propelled machine, hung from the top of the wall, which winds the wire around the tank in a continuous operation, stressing it within accurate limits and spacing it as desired. During the winding operation, the successive coils are joined together by efficient splices. This machine can place the wire at rates up to 7 miles per hour and can complete the horizontal reinforcing of the average million-gallon tank within two days.

The same high carbon wire is also used to provide the necessary vertical reinforcement for the tank walls. Groups of four or more wires are placed in vertical keys extending for the full height of the wall and are brought up to the desired stress by a hydraulic machine. The keys are then filled with pneumatic mortar to protect the reinforcement, and to bond it in the structure.

Both of these machines impart to the wire stresses sufficient not only to offset any load which the walls will carry in service, but also to provide for all losses in stress caused by subsequent plastic and elastic deformation of both concrete and steel. Since the concrete in the walls is thus kept in permanent compression, it will not crack, leak or spall.

After the horizontal reinforcement has been placed, a coating of pneumatic mortar is immediately applied to the outside of the wall to bond the wire to the wall and provide permanent protection against corrosion. For protection, the exterior coating of pneumatic mortar need be no more

than  $\frac{5}{8}$ " thick, and, when the tank design calls for multiple layers of wire, the interior coatings are only  $\frac{1}{8}$ " thick. Thus, when several layers of wire are desired, they may be applied without substantially increasing the wall thickness.

While openings for pipes and other purposes can be readily provided in the walls of these tanks, it is usually more economical to run pipe connections under the wall to a sump in the floor. Likewise, when the tanks are to be used as thickeners or clarifiers, it is preferable to place the launder on the inside rather than the outside of the wall.

### Dome Construction

The same machine which applies the horizontal reinforcement around the walls of Preload tanks also makes it possible to cover them with thin shelled domes unsupported except at the ring. Formwork for these domes usually consists of wood posts placed at suitable intervals which support concentric rings on which radial ribs, cut to the desired curvature, are installed. Standard  $\frac{3}{4}$ " sheeting is then nailed diagonally across these ribs to provide a form for a shell of pneumatic mortar or concrete reinforced with wire mesh. The average thickness of the dome shell varies from 2 to 6 inches, depending on the diameter of the tank.

After placing and curing of the dome, one or more layers of special high carbon wire are stressed around the dome ring. During this operation the dome shell rises from its forms as it comes under compression both radially and circumferentially. It is only by prestressing that this type of dome can be erect-

ed without dangerous deflections when the falsework is removed.

During the past few years, we have designed more than 200 such domes, with diameters up to 230 ft., and have built them in climates ranging from the semi-tropical to the sub-arctic. With tanks having diameters of more than 150 ft., the use of these domes permits savings in cost of 30 per cent or more over any standard type of permanent roof of equal span.

### Domes Carry Heavy Loads

Another feature of these domes is that they are capable of carrying concentrated loads at the crown. Heavy mechanisms may be suspended from the center of the dome, thus distributing their weight over the perimeter of the wall footing, instead of supporting the machines on costly special foundations which often require piles. The domes can also be designed to carry heavy uniform loads, such as several feet of earth cover for buried tanks. A notable example of this use was in a group of tanks built in 1939 for the North Shore Paper Company in Canada. The dome roofs were designed to carry 40 tons of mechanism suspended from the crown, an earth cover 2'6" thick and 50 lbs. per square foot of snow load. The total load over the entire area of the dome, which was only two inches thick, was 350 lbs. per square foot.

While these domes were developed originally as efficient, economical coverings for our tanks, they have recently been used in the design of other structures, such as aircraft hangars, suburban shopping centers, auditoriums, churches,

● DOME construction. The form work has been erected and sheeting is being placed prior to prestressing the dome.





● **WIRE is wound in continuous operation and then united.**

sports arenas and similar buildings where large spans, unobstructed by supporting columns, are desired.

#### A Typical Tank

It may be of interest to consider the dimensions and necessary materials for a typical 2,000,000-gallon dome-covered prestressed tank with an interior diameter of 111 ft. and a liquid depth of 28 ft. The floor thickness of such a tank would be 2"; the walls would be 9½" at the bottom, tapering to 4¾" thick, and the dome itself, which would have a rise of 13' 10½", would be 2½" thick. This tank would require 25 cubic yards of concrete, 372 cubic yards of pneumatic mortar, and 20,500 sq. ft. of formwork. The wire for horizontal prestressed reinforcement, in-

cluding the dome ring, would weigh 19,800 lbs., and the vertical wire units 3,150 lbs.; 19,300 lbs. of wire mesh and 11,550 lbs. of standard reinforcing steel would also be required.

Design data for prestressed concrete, together with estimates, are available to consulting and city engineers. On large general contracts involving a substantial number of tanks, Preload furnishes the designs for tanks to consulting engineers, and serves as a subcontractor to the general contractor for those parts of the job which involve prestressing. On contracts involving one or two tanks, especially of smaller size, Preload furnishes designs to the consulting engineer and can build the entire job under his supervision.

### Planning Sewage Chlorination

(Continued from page 37)

In at least one plant, it has been proposed that heavily chlorinated water (20 to 50 ppm.) be sprayed periodically (one to three times daily) over the walls and supporting columns of a weir chamber. The purpose of such treatment is to kill the slime growths that are causing concrete deterioration.

Effluent chlorination or chlorination of raw screened sewage discharging directly without further treatment, is usually for the specific

purpose of killing pathogenic bacteria and reducing BOD.

#### Minimum and Maximum Dosages

There are almost as many degrees of treatment plant effluents as there are treatment plants. Thus, the amount of chlorine required to reduce the coliforms to an acceptably low figure will also vary. It can be stated, however, according to Enslow, that the minimum and maximum dosages shown in Table I will give a residual of 0.2 ppm. after a 10-15 contact period.

TABLE I.—CHLORINE DOSAGES

Sewage or Effluent	Chlorine ppm.
Crude	
Fresh to stale	6-12
Septic	12-25
Settled	
Fresh to stale	5-10
Septic	12-40
Chemical Ppt. effluent	3-6
Trickling Filter effluent	
Normal	3-5
Poor	5-10
Activated Sludge effluent	
Normal	2-4
Poor	5-8
Intermittent Sand Filters	
Normal	1-3
Poor	3-5

It is quite evident that chlorine is a universal tool in sewage treatment. It is used ahead of the treatment plant to combat odors, to protect concrete structure and to aid in delivery of a more uniform sewage to the plant. It is used at the plant in a multiplicity of ways such as, 1) an aid to settling; 2) a means for odor control; 3) for prevention of sludge bulking; 4) for BOD reduction; 5) for controlling filter flies and ponding; 6) for the control of Imhoff tank foaming. It is used on plant effluents to reduce BOD and to kill pathogenic bacteria. To be more effective, chlorination should be planned as a part of the treatment plant and not added as an afterthought.



● **REPAIR SHOP on wheels owned by Cleveland, O. Has pump, air compressor and 110-volt generator mounted on a jeep for on-the-spot maintenance and repairs.**

## LEADERS IN THE PUBLIC WORKS

### FIELD



W. O. JONES

New President of the American Public Works Association and for the past three years City Manager of Fort Worth, Texas, W. O. Jones has long been active in the public works field. A graduate of Texas A & M, he served in the Field Artillery in World War I, and has been with the city of Fort Worth for 29 years, starting as a chairman in the engineering department and rising to City Engineer and then City Manager. He has been active in the ASCE, the TSPE and other professional organizations as well as in the APWA.

# DRILLING THE DEEPEST WATER WELL IN ILLINOIS

**EDWARD HAND**  
City Clerk, Oglesby, Ill.

**O**GLESBY, an industrial city of 4,000 in western La Salle County, Illinois, has just completed the drilling, by contract after competitive bidding, of its number three water well. This is the deepest well in Illinois according to H. F. Smith, associate engineer, State Water Survey Division at Urbana.

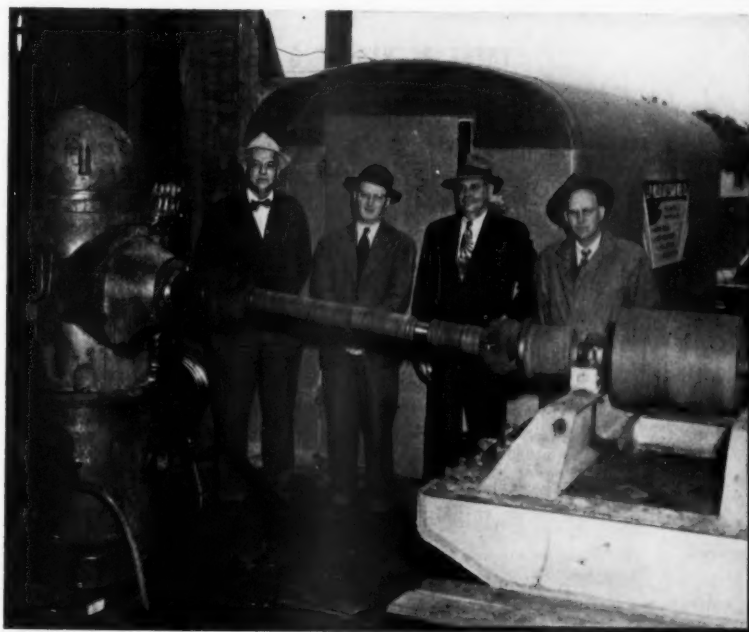
The second deepest well in Illinois is also at Oglesby. This one, our No. 2 well, was drilled in 1933 and is 2784 feet deep. Well No. 3 was drilled from 2784 to 2821 feet, to form a sump for possible caving, at no charge to the city. The No. 5 well at Peru, Ill., is 2601 feet deep and a well at Abingdon, is 2580 feet deep.

The reason for embarking on this high-cost venture in a period of high prices was the lack of a margin of safety in the relationship between the production of our existing wells and our daily consumption. Well No. 1, drilled in 1915 (1715' deep) to provide the first public water supply in Oglesby, is producing 185 gallons a minute after 34 years of continuous usage and well No. 2 is producing 350 gpm. While 185 gpm is maximum at well No. 1, it is believed that well No. 2 production could be stepped up with "shooting" and a larger pump. But Oglesby could not shut down this well for experimental purposes inasmuch as well No. 1 would not supply our 1100 consumers nor produce the 88,000,000 gallons needed each year, of which 18% is unaccounted for.

Bids for drilling well No. 3 were opened on September 7, 1948, on the following items:

The contract was awarded on September 14 to the low bidder, J. P. Miller Artesian Well company, an recommendation of the city's engineer, C. A. Ashley of the Wells Engineering Company, Geneva, Illinois.

The contractor moved in and began setting up the rig and drilling floor on November 1st. Drilling operations began on November 13th and were completed on May 14th of this year. In this six-month peri-



● LEFT TO RIGHT, C. A. Ashley, Mr. Hand, W. D. McElhiney and J. B. Millis. This photo was taken during the 24-hour test.

od, only three "fishing" jobs were encountered by the driller, none of which exceeded eight hours.

Oglesby is underlaid with three veins of soft coal and at the site of well No. 3, which incidentally is less than 700 feet from well number two, the third vein has been worked out and the mine was abandoned about 30 years ago. Drilling operations penetrated two thin veins of this coal, one at 325 feet and one at 370 feet. At a depth of 567 feet, the abandoned mine shaft was penetrated.

On recommendation of Mr. Ashley, the city council, because of the old coal mine workings and also because of caving materials encountered, authorized a rare and daring undertaking. It was decided to place a 16-inch casing from the surface to the 1238-foot depth. This pipe was successfully lowered into position and cement grout under pressure was introduced at the bottom of the 16-inch casing; the space between it

and the 24-inch and the 20-inch casing and the wall of the well outside the 20-inch casing was entirely filled with grout. Concrete was then placed between the 30-inch casing and the 24-inch and between the well wall and the 24-inch casing. During the pressure cementing, water was introduced through the sealed top of the 16-inch casing to equalize somewhat the terrific pressure needed for the successful placing of the cement.

Readers may be interested in the comments of W. A. McElhiney, president of the J. P. Miller Artesian Well company, contractors on the work:

"The unusual thing was the small margin of safety that we were operating on during cementing operations. Very few wells have been cemented as deep as this well, utilizing 16 inch casing. The part that made it risky was the fact that we did not have any choice of available pipe to cement in; and using the 16"

# TODAY'S FILTER PLANTS : use : vitrified clay filter bottom blocks

THESE PLANTS OF 8 LEADING MAKERS ALL HAVE ONE THING IN COMMON . . .

**The plants pictured here, like modern filters everywhere, are built with vitrified clay filter bottom blocks. Leading Consulting Engineers always specify them. Here's why —**

Made to strict specifications for life-time, trouble-free service, *vitrified clay filter bottom blocks* have many advantages. They are scientifically designed to provide the proper drainage and ventilation required for best operating results at all times. Solids won't cling to their smooth channels. Air circulates freely through the large top openings while the sewage flows out.

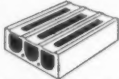
They are simple to lay, too, self-aligning and easy to work on after laying. They come with standard fittings for any type or shape of filter. They make the finest underdrains you can obtain and insure best operating results. So to get satisfaction on all your jobs, always specify *vitrified clay filter bottom blocks* made by members of the Trickling Filter Floor Institute. For engineering data, write any of the members listed below.

## SPECIAL ADVANTAGES:

Easy to Lay  
Won't Clog  
Proved by Use  
Resist Acids  
Last a Lifetime



16" Armco Filter Floor System



Pomona Terra-Cotta Block



Dickey Filter Block



Translot Block by Texas



Natick Unifilter Tile



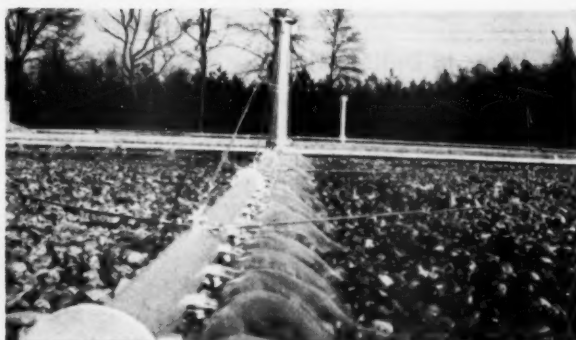
14" Armco Block by Bowerston

## TRICKLING FILTER FLOOR INSTITUTE

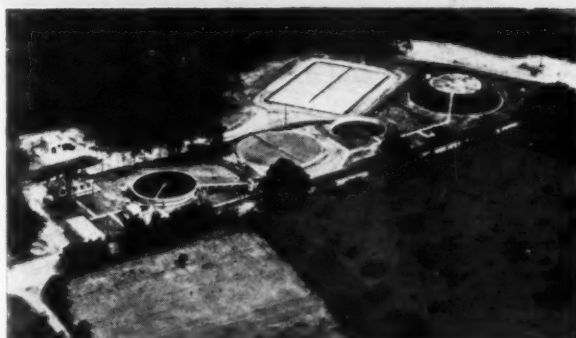
NATIONAL FIREPROOFING CORP. Pittsburgh 12, Pa.	BOWERSTON SHALE CO. Bowerston, Ohio	POMONA TERRA-COTTA CO. Pomona, N. C.	TEXAS VITRIFIED PIPE CO. Mineral Wells, Tex.	W.S. DICKEY CLAY MFG. CO. Kansas City 6, Mo.	AYER-McCAREL-REAGAN CLAY CO. Brazil, Ind.
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**AMERICAN** Well Works Bio Activation at Dell City, Okla.  
Harry Becker, Oklahoma City, Okla., Cons. Engr.



**CARTER** Trickling Filter at Richmond, Va.  
R. Stuart Royer, Richmond, Va., Cons. Engr.



**DORR** Filter Installation, Mobile, Ala.  
J. B. Converse & Co., Inc., Mobile, Cons. Engr.



**INFILCO** Trickling Filter, Wymore, Nebr.  
Harold Hoskins, Lincoln, Nebr., Cons. Engr.



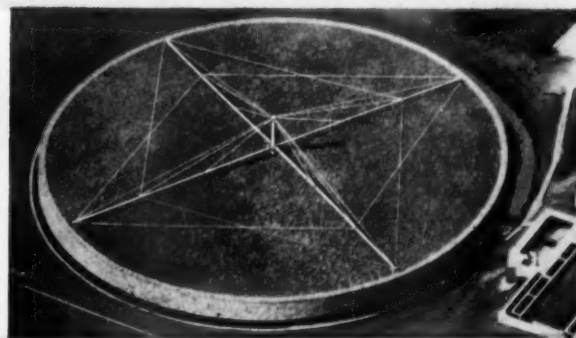
**LAKESIDE** Aero-Filter at Paris, Ill.  
Warren & Van Praag, Decatur, Ill., Cons. Engrs.



**P.F.T.** Rotary Distributors, Statesville, N. C.  
William C. Olson, Raleigh, N. C., Cons. Engr.



**WALKER** Trickling Filter, St. Mary's, Ohio  
Floyd G. Browne & Asso., Marion, O., Cons. Engrs.



**YEOMANS** Rotary Distributor, Kennett Square, Pa.  
Albright & Friel, Philadelphia, Pa., Cons. Engrs.

### Items in Drilling Oglesby Well and Low Unit Bid Prices

1. 102' 30" bore hole, per foot	\$ 23.00
2. 228' 29" bore hole, per foot	23.00
3. 270' 23 1/4" bore hole, per foot	19.00
4. 180' 19 1/4" bore hole, per foot	17.00
5. 960' 15 1/4" bore hole, per foot	12.00
6. 1045' 12 1/4" bore hole, per foot	9.00
7. 102' 30" conductor pipe, per foot	24.00
8. 330' 24" casing, per foot	15.00
9. 330' 20" casing, per foot	14.00
10. 200' 16" casing, per foot	12.00
11. 380' 12" casing, per foot	12.50
12. Cementing casings, lump sum	500.00
13. Installing Bentonite, lump sum	800.00
14. 24-hour pumping test, lump sum	1800.00

The total bid, on this basis, was \$58,553, and the low bidder was J. P. Miller, Brookfield, Ill. Next low bidder was \$59,589. There were four bidders.

pipe, which was 7/16" thick at the bottom and 3/8" thick at the top, we had to super-impose pressure on the pipe to prevent collapsing because of the pressure of the grout on the outside.

Mr. McElhiney adds: "The 29 inch portion of the hole was drilled with a Star bit, which was very successful and this bit was dressed by hard surfacing. We were running about 8500# of tools throughout the 29-inch, 24-inch and 20-inch sections of the well."

As completed the well is cased in this manner:

From surface to 105 ft. depth 30 inch  
From surface to 569 ft. depth 24 inch  
From 537 ft. to 787 ft. depth 20 inch  
From surface to 1238 ft. depth 16 inch  
From 1662 ft. to 1819 ft. depth 12 inch

The hole is drilled 15 1/4" from 1238 to 1819 feet and below that level is 12 1/4" to the bottom at 2821 feet.

On May 19th, John B. Millis of the State of Illinois Water Survey Division set up equipment for making 24-hour pumping tests. Using an 800 gpm pump, the tests started at 7:40 on the morning of May 19th and were concluded at 9:15 on the morning of May 20th. At the beginning of the tests, water stood in the well at a depth of 135 feet below the drilling floor. Pumping rate in the trial period varied from 330 gpm to 806 gpm. After pumping at the 800 gpm rate for almost 18 hours, the water level was 300 feet below the floor.

Mr. Ashley believes, from observations made on well No. 1, our original source of public water in Oglesby, that about 125 gpm of the 800 gpm from No. 1 well is from the St. Peter sandstone and the remaining 675 gpm is from the Galesville sandstone.

For the test run, the turbine pump

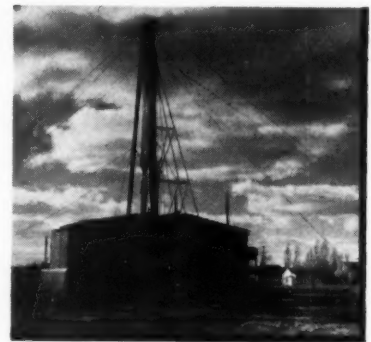
was set at 300 feet, the airline had an overall length of 316 feet. Rates of production were measured with an orifice tube and water level fluctuations were measured by the displacement method, the airline pressure being measured with an altitude gage.

### Costs and Financing

Total drilling cost of the well was \$73,979.50, an increase of \$15,426.50 over the bid price. This increase caused no astonishment to most of us who have even a little knowledge of the difficulties of drilling so deep through so many hazards, such as abandoned coal mine workings, and in caving materials.

Herewith is a tabulation of the bill in full for the drilling operations. It will be of interest to compare it with the bid made in September, 1948, to learn where the differences occurred:

Oglesby financed this improvement from cash which is generally available in cities like ours which



● THIS VIEW shows the drilling rig of the J. P. Miller Artesian Well Co., contractor.

### Actual Costs and Items for No. 3 Well Construction

1. 105' bore hole for 30" conductor pipe	@ \$23.00	\$2,415.00
2. 464' 29" bore hole	@ \$23.00	10,672.00
3. 218' 23 1/4" bore hole	@ \$19.00	4,142.00
4. 456' 19 1/4" bore hole	@ \$17.00	7,752.00
5. 575' 15 1/4" bore hole	@ \$12.00	6,900.00
6. 966' 12 1/4" bore hole	@ \$ 9.00	8,694.00
7. Furnishing and installing 30" casing, 105'	@ \$24.00	2,520.00
8. Furnishing and installing 24" casing, 569'	@ \$10.00	5,690.00
9. Furnishing and installing 20" casing, 250'	@ \$14.00	3,500.00
10. Furnishing and installing 16" casing, 1238'	@ \$12.00	14,856.00
11. Furnishing and installing 12" casing, 157'	@ \$12.50	1,962.50
12. Furnishing pump and conducting test		1,800.00
13. Cementing between casings, extra		1,050.00
14. 2026 bags cement, plus handling	@ \$ 1.00	2,026.00

Total cost of well ..... \$73,979.50

own both their electric and water utilities. The city is now taking bids on a force main to tie this new source of supply into the distribution system; on a 20'x20' concrete pump-house; and on a 500 gpm deep-well turbine pump. For the present, the city does not require the 800 gpm that well No. 3 will yield.

It is the belief of those in charge of public business in Oglesby that a palatable, potable public water is a necessity in a city with ambitions. Water must be both good and plentiful to attract industry and satisfy the householder. We feel that this goal has now been reached.

Burton Mayers is Acting Mayor of Oglesby; Joseph Donatt is the city commissioner in charge of the water department; and Burkett Moliske is its superintendent.



● SNOW PLOWS working on Route M-28, near Racoon, Chippewa Co., Michigan.

# MAINTAINING STATE HIGHWAYS

## by CONTRACT

RALPH F. SWAN

Director, Public Relations Division

Michigan State Highway Department

**C**ONTRACTING maintenance of state highways to counties has been advantageous to the Michigan State Highway Department. Under this plan, the county agrees to take over the maintenance, according to state standards, of all state highways within the county limits, and the state pays for the work on the bases explained below. The maintenance of bridge and grade separation structures is included, except where the clear span is over 20 ft. Maintenance of bridge and grade separation road surfaces that are an integral part of the structure, as laminated plank flooring, is also excepted from the maintenance contract.

The mile unit used in payment for maintenance, where distance is a factor, is the 2-lane highway. Additional lanes are computed as additional mileage. Details of the agreement are covered in a formal maintenance contract.

At the present time, 68 of the 83 counties in Michigan are maintaining state trunklines under contract with the State Highway Department. Procedure of the Highway Department in dealing with Michigan counties in connection with the

maintenance of state trunklines by contract may be summarized as follows:

Requests for a contract are initiated by the county. After the State Highway Commissioner receives a formal request from a County Road Commission for a maintenance contract, he orders an investigation made. The investigation involves the type of organization under the jurisdiction of the County Road Commission, the supervisory personnel and crew; the financial condition of the county; its garages, warehouses, maintenance equipment and repair facilities; and the character of maintenance work being performed on the county highway system.

### Set Standards Not Possible

There can be no set standard in judging these various items because, in Michigan, the counties vary from sparsely settled recreational areas, to agricultural and industrial sections. County road mileages under the jurisdiction of the county road commissions, vary from 142 miles in one small northern county, to about 2000 miles in some of the southern agricultural and industrial counties. Consequently, their equipment and personnel will vary con-

siderably. Each must be judged on the basis of the local conditions. Trunkline traffic also varies considerably in different sections of the state, both in volume and in character.

Many of the smaller counties operate with a Superintendent, under the direction of the County Road Commission, with as low as 30 men. Others have an Engineer-Manager, with a Superintendent and supervisory personnel under him, and as high as 200 men. Some counties employ a Business Manager, with an Engineer handling the engineering phases of the work and a Superintendent handling the maintenance work with a number of foremen under him.

In certain of the southern industrial and heavy agricultural counties, traffic on some of the county roads approaches that on state trunklines, and a much higher character of maintenance is required than is found in the northern recreational counties, which have very little traffic, except in the summer months when tourist traffic is heavy. Through the Department's experience working with the counties over many years, the efficiency of the operations on their county roads is fairly well known.

The Department's Engineers however, do look over the garage facilities, the condition of equipment and the number of suitable maintenance equipment units on hand, based on local needs and the particular situation. Contact is made with local business people and the Board of Supervisors to check on the efficiency and character of county operations.

### Local Conditions Are Important

The State Highway Commissioner feels that in the Michigan situation, where in most cases the Road Commissions are appointed by the Board of Supervisors, it is essential that there be a close working relationship between the Board of Supervisors and the County Road Commissions. Three county road commissioners are generally appointed for staggering six year terms by the Board of Supervisors of the county, and are required by law to make a detailed report of their operations periodically to the Board of Supervisors. Therefore, this co-operative relationship is an important consideration in considering a maintenance contract.

Since there are approximately 9400 miles of state trunklines, and 86000 miles of county roads, the average county in entering into contract, assumes the maintenance of approximately 10% additional mileage; however, the maintenance work on the state trunklines, because of the generally heavier volume of traffic, requires a higher degree of skill, better equipment and more costly maintenance, than the average county road. In entering into contract for trunkline maintenance, the State Highway Department retains supervisory control of the quality and timing of maintenance, as well as budgetary control. The Department Maintenance Engineer at Lansing, and his eight District Maintenance Engineers, exercise the same supervision of operations and budgets for contract counties as they do for direct maintenance counties. The County Road Commissions designate their Engineer, Manager, or Superintendent, as the contact man with whom the State Highway Engineer works in directing maintenance operations.

The State-County Maintenance contract is essentially a cost contract. The State pays for the labor at agreed rates, equipment rental at established rates and all materials used in maintenance operations, plus a fixed percentage for overhead. This overhead is usually 6% of the cost and covers the time, expense,

and transportation of the Engineer or Superintendent that is given to the state maintenance work, plus office and clerical help and small tools. Counties render monthly statements on forms supplied by the Michigan State Highway Department, and list the costs of state maintenance by sections and unit of operations. All these accounts are subject to audit by the State Highway Department auditors.

### Contract Maintenance Has Been Successful

The contract maintenance operation in Michigan has been very successful and economical. It eliminates duplication of garages, and supervisory personnel, and thus saves the State large sums of money annually, which can be applied to needed construction. While there is no direct profit to the counties, there are many direct and indirect advantages which produce economy of operations for the counties in both trunkline and their own county maintenance. In order to handle trunkline maintenance, counties, of course, require considerable additional equipment,

and personnel. This gives them a larger and more flexible organization which is of great benefit to them, and to their county operations. The equipment is used to a greater number of hours per year and consequently, will depreciate at a more rapid rate, and the county is thus enabled to keep up-to-date equipment in operation. The supervision of State Engineers and the generally higher character of state maintenance has the added effect of improving county personnel and operations, again to the advantage of the county system.

Another advantage to all concerned, is the local control of all the roads in the county, including state trunklines. It puts this operation closer to the people, and is an incentive to better quality of work.

Not all the remaining 15 counties in Michigan are satisfactorily equipped at this time to undertake the additional work of trunkline maintenance. This has been a controversial matter in the past, but since 68 of 83 counties are now successfully operating under this system, the benefits are evident.

## How to Winterize Your Tractor

**F**IRST look over the cooling system. It held water OK all summer, but now how about anti-freeze? Check the radiator for leaks and see that all hose and gaskets are in good condition. Be sure that all connections are tight because you don't want to lose this expensive solution.

Use a permanent, ethylene glycol anti-freeze solution in the cooling system of your tractor because it has a boiling point higher than 185° F. You can then keep your engine at normal operating temperature of 160° to 185° F. without loss of solution. A mixture of three parts permanent anti-freeze and two parts water will provide maximum protection against freezing. Test the solution periodically to make sure it is strong enough for protection against the prevailing temperatures.

The thermostat keeps the engine operating temperature at 160° to 185° F. Be sure the thermostat is in good working order. Install a new thermostat and gasket if you are in doubt.

If your tractor is equipped with a radiator shutter, use it to assist in maintaining the proper engine operating temperature. Get a radiator curtain if you don't have the shutter. Good side plates are a great help in keeping the engine warm.

### Oil and Fuel

When changing oil at temperature readings of 32° F., or below, use the SAE number recommended in the manufacturer's service manual. Oil that is too heavy may cause such a drag in cold weather on the starting motor that the engine will not start even though the battery is in excellent condition.

The fuel you used last summer may be a little heavy for winter operation. Be sure the pour point is low enough to permit it to flow freely under the prevailing operating temperatures. For cold weather operations it has been found that lighter fuels such as No. 1 Diesel have a lower pour point and the cetane number is higher along with a low distillation end point. These are the things which determine easy starting and clean burning. See your favorite oil man. He can fix you up.

After you get the proper fuel, keep it clean and don't forget to drain those sediment sumps under the fuel tank every night before you leave the tractor.

Check all electrical connections and wiring to make sure they are in good condition. Be sure the generator is charging properly. Batteries are used more severely during the winter months and must be kept

in good condition to prevent freezing. Here are some items to observe:

1. Keep tops of batteries clean;
2. Electrolyte should cover cell plates;
3. Check battery reading at frequent intervals;
4. In temperatures below 32 degrees, the specific gravity reading should not be allowed to go below 1.250.

Prolonged idling during cold weather results in low engine temperature. This will affect normal operation and may damage operating parts. Some of the results of prolonged idling and low engine temperatures are: dilution of lubricating oil, lacquer or tar-like deposits on valves, pistons and cylinder liners causing abnormal engine wear and poor performance.

When the engine is started, it should be brought up to proper operating temperature and so maintained during the time the tractor is in operation.

Don't forget to cover the exhaust pipe at night.

Clean the mud and snow out of the tracks and truck wheels and from the support rollers before leaving the tractor at night. Then park it on solid ground to prevent it from freezing down. A lot of dirt and snow will fall off if you run it back and forth a few times in a cleared solid place.

If the tractor is to be operated in Arctic temperatures, consult your nearest authorized dealer or write the factory for information regarding availability of special cold weather equipment.

These data were prepared by the Tractor Division of Allis-Chalmers Mfg. Co.

#### Traffic Control During Road Repair

The general practice for controlling traffic past a long stretch of road repairing where traffic in both directions must use a single lane, alternating the directions of movement at short intervals, is to use two flagmen, one at each end of the work. In recent jobs in San Joaquin County, Calif., considerable saving in the cost of this method of control was made by the use of traffic signals. A stop-go signal was set up well beyond each end of the work, and a single operator placed in a position from which he could see the traffic in both directions, and operate both signals. The traffic was handled much more smoothly and with less delay than would have been possible by use of flagmen, especially during cold winter weather.

#### Utilities Consulted on Paving Projects

During 1948 the city of Los Angeles resurfaced two streets through the central traffic district, in the center of the city's densest concentration of traffic. This involved removal of pavement over abandoned car tracks, construction and reconstruction of concrete gutters, curb returns and bus stops. In order that private and public utilities and city departments affected might be fully informed, a preliminary meeting of 41 representatives of 27 different

private and public utilities and other organizations was held and the tentative work schedule presented for discussion. Changes made in it as a result of this paid large dividends in the form of full cooperation by all those involved and reduced complaints and delays to a minimum.

The extent of the interest that the various utilities have in the streets of the city is indicated by the fact that in 1948 they made 39,718 excavations in the city's streets for placing services therein. The revenue from the permits for these excavations amounted to \$1,152,417.

Interior view of American-Moninger glass enclosure erected at Sing Sing Prison, Ossining, New York during summer of 1949.



## Make a "Good Neighbor" of Your Next Sewage Disposal Plant

Better "public relations" for your new sewerage plant are assured by the improved appearance and lessening of odors, insects, etc., that follow use of glass enclosed sludge and filter beds. These detailed advantages are:

- 1 Quicker sludge drying through independence of weather.
- 2 Continuous drying keeps all treatment processes "in step," adding greatly to reliability of operation.
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- 4 Prevention of insects, and confining of odors, to create impression of good sanitation.
- 5 Improved appearance by covering sludge beds, sprinkling filters, and even clarifiers help make your plant a "good neighbor."

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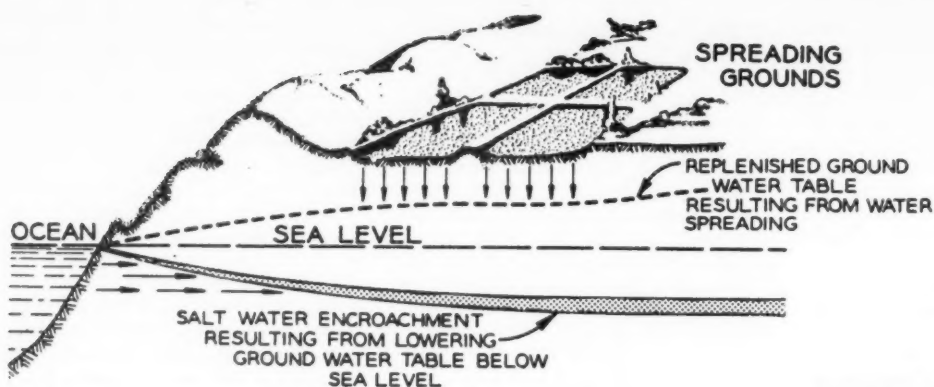


DIAGRAM shows how water from spreading grounds replenishes ground water and prevents salt water encroachment.

# Reclaiming WATER from SEWAGE

**W**ATER for Los Angeles County, California, is obtained from the streams that flow through it, plus importations from the Sierras and the Colorado river; and from extensive development of local ground water supplies. With the rapid growth of the county, the demand for water makes it necessary to prepare for increasing the supply. The ground water resources are diminishing at an alarming rate. In some areas near the coast the ground water level is dangerously below sea level.

More than 95% of all sewage and industrial waste from the County is discharged at sea, over 100 mgd from the Sanitation Districts' Joint Ocean Outfall. The idea of reclaiming a considerable part of this water for re-use was considered sufficiently attractive to lead to the appointment in January, 1948, by the County Sanitation Districts, of a Board of Engineers to study the matter. This board consisted of A. M. Rawn, Chief Engineer and General Manager of the County Sanitation Districts; C. E. Arnold, County Engineer and Surveyor; and H. E. Hedger, Chief Engineer of the County Flood Control District. This Board submitted its report on April 14, 1949. This report recites fully and in detail the findings of its investigation as to the general subject of reclaiming water from sewage and industrial wastes, and its application under the condition existing in Los Angeles County. The following is an abstract of the more essential features of this report.

Acceptable water reclaimed from sewage may be used directly in agriculture, industry and for recreational purposes; and for domestic

purposes after percolation through sand beds acting as slow sand filters and blending with other acceptable underground supplies.

## Uses of Reclaimed Water

Sewage, treated or untreated, has been used in agriculture for years. In 1948, sewage plant effluents were being so used in 124 places in the United States. Some of the mineral contents of domestic sewage are valuable as fertilizer, while others, most of them due to industrial wastes, are objectionable.

Uses of reclaimed sewage in industry are few; the most notable are the use of Baltimore's plant effluent by the Bethlehem Steel Co., and the reclaiming, by the Kaiser Fontana Steel Mill, of its own sewage for cooling purposes. To be suitable for cooling, water should not contain excessive quantities of scale-forming constituents, suspended matter, dissolved corrosive gases, acids, oil or other organic matter, or slime-forming organisms. If to be used as process water, it must meet the specific requirements of whatever process it is used for. Requirements for boiler water are very exacting and under only unusual conditions will reclaimed water be used for this purpose. It is inconceivable that it would be used in such industries as canneries, breweries or soft drink bottling.

Sewage effluents have been used to some extent in recreational activities, one of the most extensive illustrations being its use at Golden Gate Park, San Francisco, for filling several lakes, irrigating lawns, etc.

The above suggested uses envisage the direct use of the reclaimed water as it comes from the plant. When used to augment underground supplies it is spread over the ground above and allowed to soak through the soil to a greater or less depth, from which it is drawn later, usually by means of wells. The operation of the spreading grounds is subject to the general principles of slow sand filtration. This will be described later.

## Water Reclamation Plants

It might appear at first thought that a water reclamation plant is really a normal sewage treatment plant with perhaps a few additions. But there are some very significant differences between the two processes. The sewage treatment plant must process all the sewage that reaches it at any time, as and when it arrives, and dispose of all the solids removed from the sewage. But a water reclamation plant would not be required to operate at times when this would be undesirable, or with sewage of such character as to render the process ineffective, or in such quantities as might adversely affect the process. Also it would not have to dispose of the solids removed. This freedom from necessity to perform functions not directly essential to water reclamation is due to the fact that the plant would take the sewage to be treated from a sewer which had formerly led it to an outlet or a treatment plant, and which would continue to remove excess sewage not reclaimed, and also carry with it all sludge or other

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matters removed by the reclaiming process.

The fact that reclamation of only part of the sewage is contemplated is important. Some wastes contain grease and oil, hot liquids, solvents, concentrated acids, poisonous compounds, brine wastes, and other substances whose presence in sewage would render the mixture unsuitable for reclamation. It is proposed to exclude these from the sewers, or to segregate them for discharge into the sewer system at points below those at which sewage is to be withdrawn for reclamation.

### A Typical Plant

A typical plant for reclamation of 10 million gallons is described as including bar screening, grit removal, primary sedimentation, aeration (activated sludge process), final sedimentation and possibly chlorination. All primary and excess activated sludge would be returned to the trunk sewer below the plant.

At another locality an 8 mgd activated sludge plant which is no longer in use would be modified for reclamation purposes as follows: The bar screen would be utilized as is. The comminutors and grease trap would be by-passed and the sewage led to a primary sedimentation unit giving 1 hr. detention. The aeration tanks, reaeration tanks, blowers, final clarifiers, sludge pumps, motors, etc. would be used with only a few minor modifications. A few trickling filter plants that are to be discontinued could be used for reclamation with only minor modifications. They include pre-aeration, primary clarification, trickling filtration, secondary clarification and chlorination.



● SPREADING grounds at Rio Hondo, basins filled with water.

The sludge digesters would not be used.

In dealing with the economics of the problem of water reclamation from sewage as a means of replenishing depleted underground water basins, an obvious yardstick is offered by the probable cost of surplus Colorado river water to be purchased from the Metropolitan Water District. Negotiations indicated that unsoftened water could be obtained for \$15 per acre-foot (about \$46 per million gallons), and softened water for \$20. There would be the additional cost of conducting the water to the spreading grounds. The cost of reclaiming water at each of the several plants considered was estimated on a 50-year basis. For the new activated sludge plant, the cost would be \$55.40 per million gallons. For existing plants, including purchase from their present owners, the

costs were estimated at from \$28.40 to \$58.20, averaging \$37.32.

### Water Spreading

Water spreading has been practiced successfully for a long time by the Los Angeles County Flood Control District, but not with sewage effluent. To establish a proper spreading procedure applicable to sewage effluent on fine sand, a test basin was prepared and operated with an oxidized, stable secondary sewage effluent. (The use of primary effluents is not recommended because of possible odors and the sealing effects of additional suspended solids.) The soil at a depth down to 4½ ft. had an effective size of 0.44 mm and uniformity coefficient of 4.25-4.00. From 4½ to 6 ft. depth the effective size was .090 and the uniformity coefficient was 3.60.

The data from this experiment indicate that an oxidized, stable effluent may be applied to the contemplated spreading grounds for seven consecutive days at an average rate of 1.0 acre-foot per acre per day. Each of the basins into which the spreading ground is divided would be filled for 7 days, and during the following 7 days would be de-watered, dried, and cultivated. Samples taken from 4-ft. to 7-ft. depths under such conditions showed the absence of pollution (zero coliform index) and the existence of aerobic conditions at all depths. The re-oxygenation of the spread effluent by the atmosphere was indicated to be greater than 45 lb. of oxygen per acre per day. The average B.O.D. of the unchlorinated secondary effluent was 7 ppm prior to spreading, while the percolated samples (taken at depths of 4 to 7 ft.) were uniformly free of B.O.D.

As a basis for estimating the



● GROUND cultivated and ready for water spreading. In favorable soils, a 12-inch depth of water can be applied daily for 7 days, but must be followed by 7 days drying and cultivation.

spreading area necessary for continued successful spreading, an average rate for the two-week period of 161,500 gallons per acre per day was assumed.

In general, it was concluded that the effective use of waters reclaimed from sewage in a spreading operation is contingent upon the following:

1. A proper spreading ground; sandy areas permitting an adequate percolation rate into usable underground waters after effecting proper purification in the natural sand filter.

2. A water reclamation plant which, without producing odors or pollution problems, will economically produce an effluent suitable for spreading.

3. The existence of an adequate supply of sewage within a reasonable distance of spreading areas.

4. A reclaimed water which will not exceed permissible limits of mineral content.

5. A water reclamation plant not required to assume any of the obligations of sewage disposal.

6. When sewage reclamation spreading is combined with flood water spreading, there must be sufficient pumping draft on the area to

maintain the water table at least 25 feet below basin beds during the wet cycle in order to permit the required high rate of flood water spreading.

### Diesel Engine Training Program

A training program for owners and operators of its diesel engines has been developed by the Detroit Diesel Engine Division of General Motors. This program includes a complete service training facility, all contained in a 2-ton truck. Courses are designed for 2 or 3 days duration, depending on the owner's needs and desires. Instruction includes: Operating characteristics, engine construction, maintenance and repair, tune up and diagnosis, and preventive maintenance.

### Skidding and Surface Texture of Pavements

The differences in the skidding performance of various surfaces when wet appear to be related to differences in surface texture. Two methods of studying surface texture have been employed by the English Road Research Laboratory in the investigation of the relationship between surface texture and resistance to skidding.

Texture printing was developed as a means of obtaining a record of the portions of a road surface which make contact with a tire.

For this purpose half-tone black printing ink is applied to a portion of the surface, and a rubber roller with the same effective hardness as that of a tire is rolled over it. The roller becomes inked where it comes into contact with the road surface and the resulting impression is printed on to fair quality calendered paper. Individual contact areas as small as 0.001 in. in diameter can be recorded by this method. As a means of recording surface texture the method has a number of advantages, the technique is simple, the prints are permanent and easily stored, they can be repeated as often as desired, and are large enough to be really representative of the surface.

Texture prints from surfaces which have a high resistance to skidding show white zones corresponding to the peaks and sharp ridges of the stones in the surface. This indicates that the effect of such sharp peaks is to produce intense local pressures between the tire and the road surface such that any intervening liquid film on the surface (in this case the printing ink), is squeezed away. Thus in the case of road surfaces on which this effect is obtained, the tire still comes into contact with dry portions of the road even although the road itself is wet, and as a result, a high resistance to skidding is obtained, comparable with that of the same surface when dry.

Theory suggests that the peak pressures which occur are determined more by the shape of the projections in the road surface than by their size.

Although texture prints throw this light on the way in which a high resistance to skidding is obtained on wet surfaces, no satisfactory method has yet been found by which the skidding performance of road surfaces can be predicted from them.

An interesting question is how large the projections in a road surface must be if a high resistance to skidding is to be obtained, and this has led to the measurement of the "Texture Depth" of road surfaces. The determination of "Texture Depth" is made by pouring a known volume of fine sand of uniform particle size on to the road surface and spreading it into a circular patch so that the "valleys" are just filled up to the level of the peaks. The "Texture Depth" of the surface is then defined as equal to the volume of sand poured on to the surface, divided by the area of the patch obtained.



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**If you want to improve your sewage plant effluent,** we urge you to investigate our Spiraflo Clarifier. Excellent skimming and settling by the Spiraflo means better results. For a test comparison between actual quiescent settling and Spiraflo results see our new Spiraflo bulletin off the press in September 1949.

Lakeside's new water softener bulletin No. 78 is chock full of valuable information for the designing engineer, purchaser and operator. If you have not received a copy please write for one.

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and is generally expressed in inches.

When texture depth is measured in this way, no account is taken of the shape of the surface projections, so that strictly the method can be used only for the comparison of surfaces with projections of the same shape. In this way it has been found that, given projections of suitable

shape, a high resistance to skidding on wet surfaces at speeds of the order of 30 mph can be obtained with a "depth" as little as 1/40 in.

By C. G. Giles, Esq., B. Sc., of the Road Research Laboratory, Department of Scientific and Industrial Research (England). Highway Research Abstracts, February, 1949.

## Stabilizing a City Refuse Dump

**A**N experiment was conducted by the New York State Dept. of Public Works, at Binghamton, N. Y., on the compaction of a city dump to permit the construction over it of an arterial highway. The following data are from a preliminary report by George W. McAlpin, Chief Soils Engineer.

The dump, which is composed of the usual dump refuse—paper, rags, wood, ashes and other junk—has a depth of 5 to 20 ft., and is variable in composition, depending on the time and rate of dumping the various components. The dump is located on low flat land, along a creek, and is underlaid with unconsolidated organic silt and clay. There is a light covering of earth.

Two compaction tests were con-

ducted on seven test sections, each 200 ft. long and 20 ft. wide, and laid out over the various sections of the dump so that fills of different ages and compositions would be included. Progressive elevation profiles were taken to measure the amount of compaction or displacement.

On five sections, compaction tests were made in three stages. In the first stage, a Bros pneumatic tired roller with oscillating wheels was used, unloaded, weighing 12 tons. Twelve full passes were made; the roller-compactor was then loaded to 31 tons and the same areas were rerolled twelve times. In the final stage, the compactor was loaded to its full capacity of 50 tons and the areas rolled until there was no measureable settlement. During these

stages of rolling, local weak spots developed, with the compactor sinking as much as 4 ft. into the dump. These areas were filled and leveled off with a thin layer of gravel before rolling was resumed.

In the second series of tests on the other two test sections, the compactor was used at its full 50-ton capacity. The object was to determine the comparative results obtained on material previously compacted by light rolling, and on material not previously compacted.

It was the opinion that a more satisfactory construction practice resulted if the sections were rolled with a 30-ton load, local depressions were smoothed with sand and gravel, and rolling was completed with the 50-ton load. The preliminary rolling and leveling with sand and gravel provided sufficient strength so that the 50-ton unit could operate effectively and with less delay.

The average amount of settlement over the fill was 1.5 ft., with some localized depressions to 4 ft. There appeared to be an increase in the density of the fill to a depth of 4 to 5 ft. A final decision on the feasibility of the method for this particular situation has not been made.



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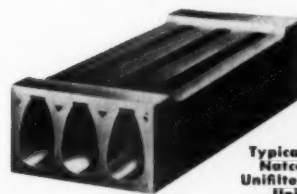
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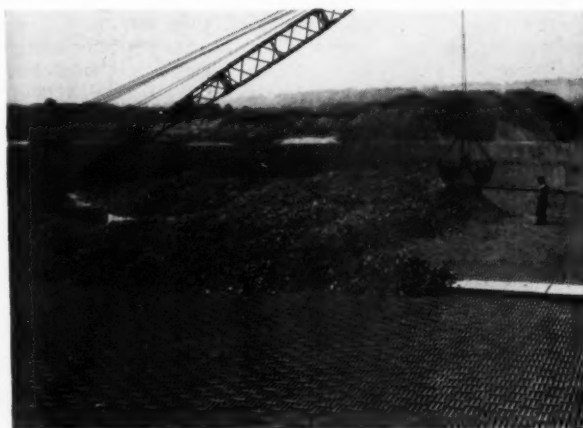
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# NATCO UNIFILTER BLOCKS

**for Trickling Filter Beds of  
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Natco  
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Sewage Treatment Plant—1 ST Unit—Worcester, Mass.  
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Sewage Disposal Plant at Ten Mile Creek near Mobile,  
Alabama with filter beds of Natco Unifilter Blocks.

Here are two typical Unifilter installations—one, the largest in the world, located in Worcester, Massachusetts—the other slightly smaller in Mobile, Alabama.

Natco Unifilter Blocks readily adapt themselves to any standard type of filter bed where trickling filters are used. Their rugged fire clay walls provide sufficient structural strength to support the weight of any kind of filter medium. In addition, future maintenance and repair costs are low.

Natco Unifilter Blocks are vitrified and salt glazed. The smooth drainage channels afford an efficient run-off with minimum absorption. The design provides adequate capacity for drainage and air supply.

Convenient hand hold makes for greater speed and ease of handling. Long and short pieces and blocks, mitred to various angles, are furnished where required.

Our Engineering Department will gladly cooperate in working out the most efficient and economical use of Natco Unifilter Blocks on any disposal plant proposition where trickling filters are to be used.



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# HOW COPPER SULPHATE IS USED FOR ROOT CONTROL in SEWERS

**JOHN W. HOOD**

Superintendent of Sewage Treatment,  
Ridgewood, N. J.

**R**OOT and fungous growths have long been recognized as serious factors in the obstruction of house and sanitary sewers and storm drains. Various methods have been employed to mitigate the problems created by them. Treatment with copper sulfate has been found practical and economical. Roots of trees and shrubs, in their search for food and moisture, often penetrate the pipe joints and obstruct the flow in the conduits. It is not possible to dig up all pipes and repair the leaky joints, nor is it desirable to destroy the trees. Copper sulfate appears to offer a solution that is low in cost and does not harm the trees or shrubs.

Over a considerable period of use, practical methods of applications have been developed in Ridgewood. It has also been found that, in this part of the country, an annual application of copper sulfate is sufficient to control root growths and prevent the system from becoming reseeded with fungi and slime growths.

## Treating House Connections

For a variety of reasons, a pre-dominance of root troubles occurs in the pipes connecting buildings to the street sewer. Consequently, effective treatment is possible only by introducing copper sulfate from within the contributing building. This requires the cooperation of the homeowners. In the initial stages of the program, it was found extremely helpful to circularize the homeowners with explanatory data and to enlist the aid of the local newspapers. As a result of this approach, the number of people who did not cooperate was extremely small.

To facilitate the procedure of treatment, cardboard containers, similar to those used for holding ice cream, were filled in advance from bulk stocks of copper sulfate and loaded into any type of light vehicle. The average dose for a home is two

pounds. The municipal employee, in covering a residential area, follows by a day or two the circular sent to the homeowner. He may wear street clothes and he enters the home with only a carton as his equipment. The copper sulfate crystals are placed in a flush toilet in convenient increments, followed by two or three flushings to carry them into the house sewer line. Where serious root troubles have been encountered, a somewhat higher dosage may be required, with repeat treatments.

The copper sulfate crystals should never be placed in sink or tub traps. If the crystals remain in contact with the thin-walled metal pipes, corrosion may occur, with possible failure. If it is desired to treat such fixtures, a solution of the copper sulfate should be prepared and poured into the pipe, with a short contact period before flushing. Also, copper sulfate may have an adverse effect on chrome plated sink drains and piping. However, a reasonable amount of care prevents any trouble from these sources. Selection of an intelligent man for this work results in the creation of good impressions on householders and the avoidance of such possibilities for complaint as are listed above.

## Sewer Mains and Laterals

In treating sewer mains and laterals, junction and terminal manholes are opened and about two pounds of crystals sprinkled along the invert of the sewer in such a way as not to interfere with the flow. The amount is increased in areas where serious root troubles are known to exist.

Periods of low to normal flow of sewage are best for treatment of this type. Both the time of contact and the concentration of the resulting solution are enhanced. Preventive doses are made annually. Old roots do not return, but new root infiltrations may develop.

The amount of material used in

any given area during a specific time should be determined in cooperation with treatment plant personnel. A careful filing system and a map record of the work should be kept, not only to insure a complete coverage of the system but also to enable results to be checked and procedures modified to suit the needs of local conditions. Some sections will require a heavier initial treatment than others. Where sewers are completely stopped, mechanical methods for opening them must be utilized. The crystals do not readily dissolve in the absence of flow.

## Pumps, Force Mains and Storm Drains

Accumulations of biological growths on the inside of force mains may build up head on pumps far above their designed capacity. Such growths are often slimes or fungi. Application of the copper sulfate crystals in a bag in the inlet well is usually effective in causing an astonishing sloughing of such formations. The tell-tale liberation of H<sub>2</sub>S at the point of discharge also ceases, with elimination of odor complaints.

In storm drains there is no constant flow and some modification in methods is necessary. It is best to select a time when there is some, but not an excessive flow. Under such conditions, the same general methods apply as for sanitary sewers.

## What Not to Do

Copper sulfate crystals should not be placed in metal vessels or in fixture traps, or corrosion will occur. Plenty of flushing water should be used to insure that all of the crystals are carried beyond the house soil piping; however, the reaction of copper sulfate with cast iron soil pipe is negligible.

Don't expect magical results. Some time is required to kill the root cells and the normal processes of decay and decomposition must ensue thereafter. Spectacular results are

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*This article is a condensation of a booklet on this subject, prepared by the author, and now in process of publication by Phelps Dodge Refining Company, New York, New York. A copy of the complete booklet is available on request.*

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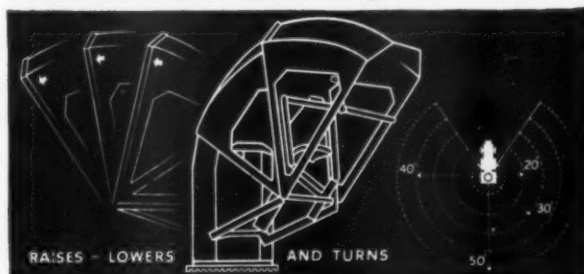
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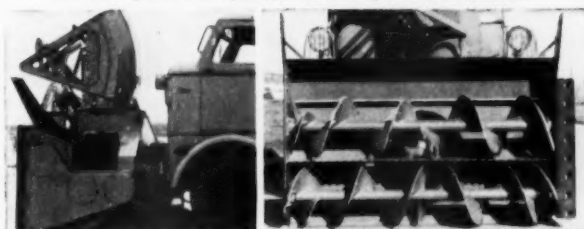
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sometimes obtained when fungi and slime, which are affected more quickly, are principally involved, as in force lines and main sewers.

Don't waste copper sulfate during periods of high flows. The dilution factor may be too great and the time of contact too short to obtain results. Also, don't expect copper sulfate to relieve stoppages due to defective pipes, damaged joints, deposits of grit or silt or similar causes.

Medium sized crystals are preferred because, in contact with root masses or fungi, these crystals leach

copper solution over a longer period of time than the finer grade material.

#### Results in Ridgewood

Four man-days per year are expended on the sewer mains serving a population of 18,000 in Ridgewood. Benefits over the past 12 years during which we have used copper sulfate have been cumulative and substantial. Stoppages are of infrequent occurrence; odors are absent alike from sewers and the treatment plant; structural disintegration has been stopped; pump efficiencies have been

improved; and the better condition of the plant influent has resulted in an increased plant operating efficiency.

In our 12 years of using copper sulfate, we have found no indication of any damage to trees or shrubs. There is no record of any effect, other than beneficial, on the sewage treatment process. Such beneficial results accrue largely from the fact that free-flowing house sewers, and clean laterals and mains bring the sewage to the plant in a fresher and more uniform condition.

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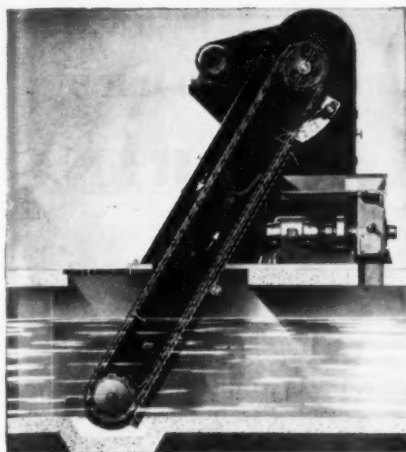
### Recapping Wayne County Concrete Roads

The major part of the highway system of Wayne Co., Michigan, was paved with concrete 20 to 25 yr. ago and very little of it has been replaced. Under increasingly heavy traffic, pot holes and surface breakage have occurred in the older roads, but they still have good foundations and generally adequate drainage. The solution adopted is that known as recapping. When a concrete pavement becomes broken and rough, no amount of patching or sealing will satisfy traffic. But add to this patching and sealing a good flexible type of riding surface such as asphaltic concrete, the life of a concrete pavement may be extended another ten or fifteen years. Although the initial cost as compared with sealing and patching is higher, in the long run it is much more economical and the character of the road is changed immediately.

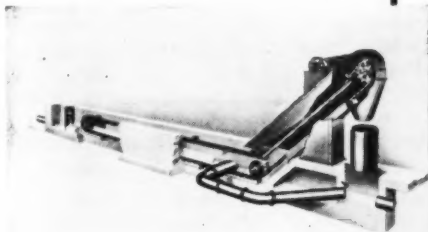
### Mileage Markers Have Many Uses

Arizona has installed concrete mileposts along all federal aid and other state highways. These markers are concrete, three-sided posts, six feet long, six inches on a face, with numbers cast into the posts from interchangeable aluminum plates.

The mileposts indicate the number of accumulated miles along a route, from either the western or southern boundary of the state. One of the primary reasons for installing the mileposts was to make it easy for investigators to fix accident locations accurately. Once the mileposts were set, other uses were quickly found for the markers, including: Simplified control of maintenance cost-keeping on each mile of highway; easier reference to the location of needed road repairs; quicker location of proposed road improvement projects; better control of traffic-counter placement and traffic-census data; and identification of construction projects by route number and from milepost number to milepost number.

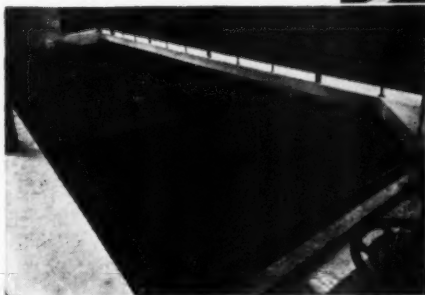


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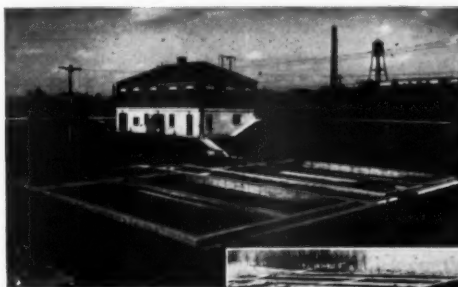
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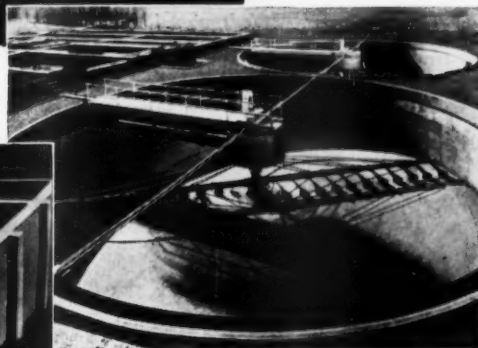
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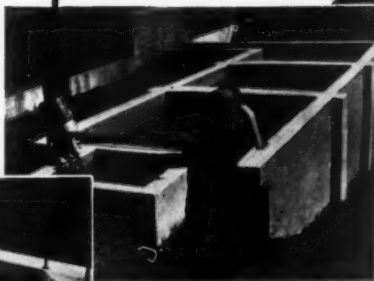
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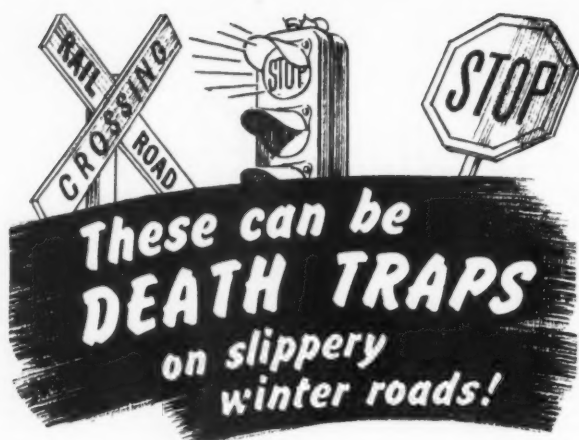


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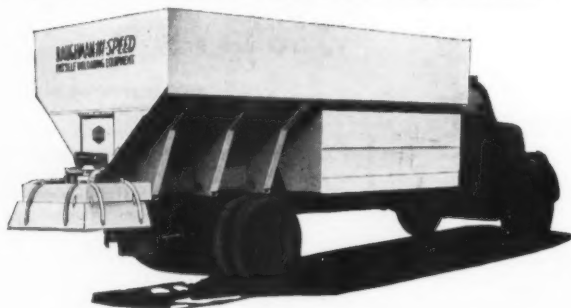


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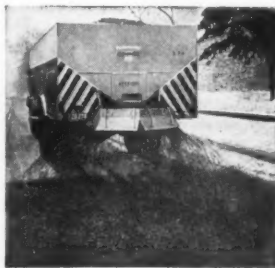
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## PUBLIC WORKS ENGINEERING DATA

### Variations in Water Consumption

The maximum daily water consumption in New Bedford, Mass., during fiscal year 1948 was 22,405,624 gallons on August 16. The minimum consumption was 8,604,854 gallons on May 30. The average daytime consumption, from 6 A.M. to 6 P.M., was 9,383,960 gallons, as compared to the average nighttime consumption, from 6 P.M. to 6 A.M., of 6,352,616 gallons. Average daily consumption was 15,740,576 gals. Lowest month was February, with a daily average of 14,465,084 gals.; highest month was August, with a daily average of 18,499,472 gals. Based on New Bedford's population of 109,353, average consumption per inhabitant was 123 gals.

### Identifying Highway Department Vehicles

All roadway vehicles owned by the Texas Highway Department, except passenger automobiles, are painted a bright yellow. This was done as a safety measure to reduce the accidents to construction and maintenance personnel by drivers who failed to slow down when approaching work areas. It is believed that the brightly colored vehicles and the generous use of red flags will help reduce accidents.

### Cost of Meter Maintenance

Costs for maintaining meters in New Bedford, Mass., for the fiscal year 1948 are given in the annual report as follows:  $\frac{5}{8}$ -inch, 756 meters repaired, average cost \$7.93, and 86 meters cleaned and tested, average cost \$3.28;  $\frac{3}{4}$ -inch, 179 meters repaired, average cost \$8.59, and 28 meters cleaned and tested, average cost \$3.22; 1-inch, 34 meters repaired, average cost \$9.15, 7 meters cleaned and tested, average cost \$3.31. For  $1\frac{1}{2}$ -inch meters, similar costs were \$16.45 and \$6.50; and 2-inch meters \$30.61 and \$9.50.

### Standard Locations for Meter and Shut-off

In order to facilitate meter reading and repair work, Tacoma, Wash., has standardized the location of the meter and shut-off, so far as possible placing these just inside the curb and immediately in front of the premises served. However, many irregularities still exist due to lack of uniform standards of the past; to marginal developments caused by running long services and small steel mains from the nearest standard main; and to irregular practices by private water companies later taken over by the city. W. A. Kunigk is superintendent of the Water Division and C. A. Erdahl is Commissioner of Public Utilities.

# PUBLIC WORKS DIGESTS

SEWERAGE AND REFUSE. .67 • HIGHWAYS AND AIRPORTS. .73 • WATER WORKS. .78

*This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.*

## SEWERAGE AND REFUSE

### Refuse Incineration Adopted for New York City

For several years New York City has been disposing of its refuse by land fill, existing destructors were shut down or demolished, and only about  $\frac{1}{2}$  of all refuse disposed of by incineration. But all dumping areas close to points of collection have been used up, some of those now being used requiring a 15-mile haul. In the future, land fill will be used only for ashes, incinerator residue and non-combustibles. The city proposes to build five new destructors with a combined capacity of 4,000 tons per day, and to modernize five existing incinerators. The first to be built will be the Betts Ave. destructor, with a capacity of 750 to 800 tons in 24 hr., to serve a population of 500,000 to 600,000. It will include provision for shredding material; furnaces equipped with travelling grates for automatic feeding, drying and stoking; and residue quenching pits with drag conveyors for loading to trucks. The burning rate on the burning grates will be 95 lb. per sq. ft. per hr., or 69.5 lb. per hr. for combined area of burning and drying grates. About 6 lb. of air preheated to 300° F per lb. of refuse burned will be provided for combustion.

The collection equipment also is to be modernized, replacing that used far beyond its useful life during the war scarcity. Trucks with mechanical compacting loading devices will be obtained, to hold compacted loads of over 3 tons, in place of the 2 tons average collected by the old trucks. They will be weighed at the entrance to the tipping floor

on a 20-ton scale. Experience with such scales has demonstrated the possibility of weighing 70 loads per hr.

Henry Liebman—"New York City Adopts Incineration for Refuse Disposal"; PUBLIC WORKS, September.

### Improving the Activated Sludge Process

Improvements in the activated sludge process can be made in (1) Sedimentation of raw sewage before aeration. (2) Closer control of sludge age in the aeration systems. (3) Concentrating excess activated sludge in separate tanks. (4) Relocating effluent troughs and sludge-removal outlets in final settling tanks to take advantage of density currents. (5) Correlating air supply with abstraction of sewage impurities. (6) Regularized re-conditioning of air-diffusion media. (7) Employing step aeration to reduce tankage, improve control or handle greater-than-design flows. (8) Utilizing "modified sewage aeration" processing where complete treatment is not required.

No. 1—Removal of solids by sedimentation is cheaper than by aeration. No. 2—Step aeration permits the most flexible application of sludge age control and a reduction in the size of aeration tanks. No. 3—Seldom is it desirable to waste secondary sludge to primary tanks. No. 4—Locate effluent weirs near the influent end of final settling tanks. No. 5—Use the oxygen demand in the tank for controlling the air supply. No. 6—Routine reconditioning of air diffusion media. No. 7—This will permit reducing the concentra-

tions of the aeration tank effluents. No. 8—Another name for this is "high-rate activated sludge."

Richard H. Gould—"New Horizons for Activated Sludge"; *Engineering News-Record*, Sept. 1.

### Control of Wastes Treated With Sewage

The Allegheny County (Pa.) Sanitary Authority will accept industrial wastes for treatment in conjunction with municipal sewage if they will affect neither structures nor treatment processes. Studies of the wastes from 30 industries led to the conclusion that they would be acceptable for treatment by activated sludge provided that pretreatment, conditioning or regulation of flow be furnished in certain cases. Pickling liquor wastes are not acceptable because of both acidity and high iron content. Concentration limits for toxic and deleterious wastes have been set at 5.0 ppm total iron, 1.0 ppm for copper, 3.0 ppm for chromium, and 2.0 ppm for cyanide. Mineral oils to be excluded and soluble oils as fully as practicable. Free mineral acids to be neutralized at source. Combustibles and acetylene generation sludge to be excluded. It was estimated that the composite sewage that will reach the central treatment plant will have a B.O.D. of 300 ppm, and 275 ppm suspended solids. Extra charges will be made for wastes that exceed these limits, proportional to such excess, the charge rate being based on the estimated increase in cost of treating the excess volumes of suspended solids and B.O.D. The extra charge is nominal; for 500 ppm sus-

pended solids and 500 ppm of B.O.D. it would be 11.7% of what the bill would be if based on quantity alone. An additional charge will be made for excessive chlorine demand.

J. F. Laboon—"County Plant to Handle Wastes"; *Sewage Works Engineering*, September.

### Treatment for Harrisburg's Sewage

Plans have been completed recently for a plant to treat 23 mg of sewage from Harrisburg and Steelton, Pa., which contain some unusual features. The plant is designed to

remove practically all of the settleable solids, reduce the B.O.D. 35%, provide sterilization of the effluent and satisfactory sludge disposal. Space is provided for an activated sludge plant if and when secondary treatment should be required. Four pumping stations are necessary. The largest (for 43 mgd peak flow rate) has a circular dry well enclosed by an annular wet well, because of the deep excavation required. With magnetic couplings on two of the four pumps, their speed can be varied to approximate the rate at which the sewage reaches the sta-

tion; the pump motor then will operate at a constant power factor and comparatively high efficiency at all speeds, and the wet well can be made smaller.

The treatment will consist of 20 min. of mechanical flocculation, 90 min. of sedimentation, and 15 min. in chlorine contact tanks. Weir plates of  $\frac{1}{4}$ " steel with V notches at 6" centers are adjustable by means of threaded lifts near the ends of each plate. Sludge and scum disposal will be by stage digestion, elutriation, vacuum filtration and incineration.

C. M. Pepperman — "Primary Treatment Project Planned for Harrisburg"; *Sewage Works Engineering*, September.

### Disposal of Dairy Wastes

Waste prevention measures can do more toward reducing the strength of wastes discharged from a milk products plant than the same effort applied to waste treatment. Waste prevention at the plant of the Belle Center, Ohio, Creamery Co. reduced by 60 to 70% the B.O.D. load to be treated. The major items responsible for this were 1. Collection of drip and first rinse from the can washer. 2. Collection of first drainage from raw milk storage tanks. 3. Installation of electronic alarms on storage tanks to prevent overflow. 4. Direct connection between whey pump and piping and the cheese vats. 5. A pan under the cheese press to collect the press water. 6. An educational campaign among plant employees.

The waste at this plant was treated by the activated sludge process. It was found that the minimum aerator capacity to insure an effluent B.O.D. consistently below 15 ppm should be 80 gal. per pound of B.O.D. per day. For a typical waste having a B.O.D. of 1,000 ppm, the volumetric detention period should be about 16 hr. based on the raw waste flow, and a dissolved oxygen content of 1 to 4 ppm in the aerator and a trace or more in the clarifier must be maintained. Apparently, within a range of 800 to 1400 ppm B.O.D., the flow of return sludge should vary from 600 to 700% of the raw waste flow, and the required suspended solids concentration in the mixed liquor will vary from 5,000 to 6,000 ppm. The optimum air requirement, using a jet diffuser, was about 1 to 1.2 cfm per pound of B.O.D. per day.

Edward F. Eldridge—"Dairy Waste Disposal"; *Sewage Works Journal*, July.



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## City

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changes are produced by so complicated a process. The author, in this paper, attempts to do this, setting forth in mathematical form the equations relating to the sludge volume index and the rates of flow in various parts of the process. He shows the desirability of maintaining aeration tank solids at a high level and the difficulties caused by limited return sludge and waste activated sludge pumping facilities. He suggests the difficult problem brought about by the returning of digested liquor to the primary set-

ting tanks or sludge concentration tanks during periods of high sludge volume index activated sludge, particularly when accompanied by high solids concentration in the digestion overflow.

L. S. Kraus—"Quantitative Relationships in the Activated Sludge Process"; *Sewage Works Journal*, July.

#### Oxygen Requirements Of Activated Sludge

One of several methods available for measuring the biological activity

of activated sludge is the direct absorption of dissolved oxygen. (See *Sewerage Digest* for June 1948). Studies for determining the procedure most suitable for making such measurements were conducted in the laboratory of the Birmingham, Tame and Rea District Drainage Board, England, beginning in 1944. Among the conclusions reached were: The oxygen taken up by washed activated sludge was proportional to the amount of sludge involved and to time of aeration. The sludge should be washed; the aeration flasks kept in the dark to prevent photosynthesis. Below pH 5 and above 12, the oxygen uptake is very small; the optimum pH is between 7 and 8. The optimum temperature for oxidation is about 28° C; where it is three times as rapid as at 12° C. Above a certain minimum concentration, dissolved oxygen had little effect on the rate of oxygen uptake by activated sludge. Practically all the oxygen demand was found to reside in the solid portion of activated sludge and to be biological in origin.

P. S. S. Dawson and S. H. Jenkins—"The Oxygen Requirements of Activated Sludge Determined by Manometric Methods"; *Sewage Works Journal*, July.

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New York City Adopts Incineration for Refuse Disposal. By Henry Liebman, Dept. of San., New York City. September, Pp. 41-44.

#### Sewage Works Engineering

County Plant to Handle Wastes. By J. F. Laboon, Chairman Sanitary Authority. September, Pp. 422-424.

Primary Treatment Project Planned for Harrisburg, Pa. By C. M. Pepperman, Consult. Engr. September, Pp. 425-427, 445.

Electrification of Sewage Treatment Processes. By Victor Greiff, Bureau of Sewage Disposal Design, New York City. September, Pp. 428-431.

Instrumentation of Sewage Treatment Processes: Control of Industrial Waste Treatment. By A. O. Pearson, Brown Instrument Div. September, Pp. 432-433, 446.

Liability of City for Sewer Overflows. By Leo T. Parker, Attorney at Law. September, Pp. 434-436.

Chemical Treatment Plant for Packing House Wastes. By Jack Huppert, Texas Filter Co. September, P. 437.

#### The Surveyor (England)

Filtration of Part Flow of Primary Tank Effluent in Admixture with Humus Tank Effluent from Remaining Flow. By F. Oliver, Mgr., Harrogate Sewage Works. Aug. 5, Pp. 469-471.

#### Water and Sewage Works

Oxidation-Reduction Potentials in Sewage Treatment. By John W. Hood, Supt. Treat. Wks., Ridgewood, N. J., and Gerard A. Rohlich, Assoc. Prof. Hyd. & San. Engr., Univ. of Wisconsin. September, Pp. 352-354.

Preconditioning and Digestion of Sewage Sludge. By T. R. Haseltine, The Chester Engineers. September, Pp. 355-358.

Eroded Sewer Quickly Repaired with Corrugated Pipe. By Thomas B. Ray, City Engr., New Rochelle, N. Y. September, P. 362.

### Unusual Features in Laying Large Pipe Sewer

In connection with a flood control project being constructed in and near Elmira, N. Y., by U. S. Engineers, 3,950 ft. of 48" to 96" asbestos-bonded corrugated metal pipe were laid along the Chemung river in Elmira. About 650 ft. were under overhanging buildings, where it was impossible to place the pipes by means of cranes. Here, a boom attached to the blade of a large bulldozer, and inserted into the pipe, picked it up and carried it to its final position, the bulldozer traveling in the trench.

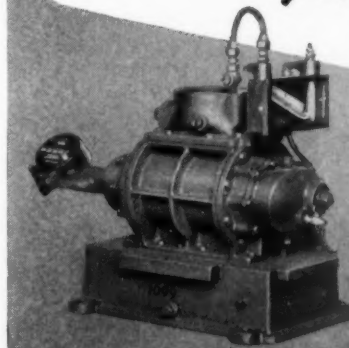
At another point an 84" pipe was carried across an approach to a bridge. To avoid congesting traffic by laying the pipe in open cut, the contractor drove a 96" Armco liner plate tunnel 60 ft. long under the approach and threaded the 84" pipe through this, the 6" annular space between the pipes being filled by pressure grouting.

### Stream Pollution and Soil Conservation

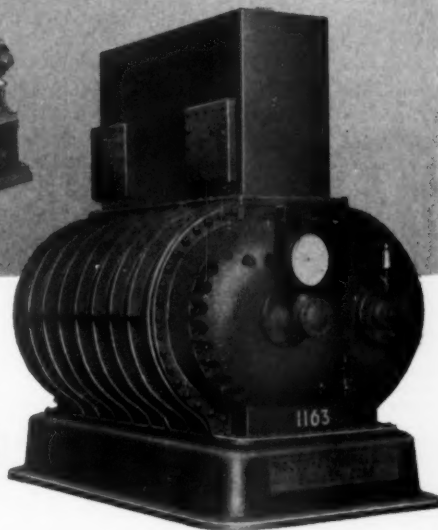
The Interstate Commission on the Potomac River Basin was created in 1941 to secure control and abatement of pollution of that river. The first activities of the Commission dealt with pollution by sanitary sewage and industrial wastes. It is now

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concerning itself with pollution through soil erosion. In April, 1949, the Vice-Chairman of the Commission, Harold A. Kemp, explained the importance of this type of pollution to the city dwellers as well as to the farmers. Some of the facts and figures he presented are abstracted below.

The average annual mud load of the river is 1,700,000 tons, an equivalent of 2 square miles of top soil 6" deep. During one flood the turbidity reached 6,000 ppm, resulting in the death of vast numbers of fish and damage to oyster beds. It is estimated that adequate soil conservation can keep the turbidity below 100 ppm for 95% of the time. If this were done, the city of Washington could reduce the cost of treating its water supply by \$34,000 per year for chemicals, \$5,000 for cleaning the filters, and \$12,000 for dredging the reservoirs.

Also it is estimated that \$60,000 a year could be saved in the cost of dredging the river channel to keep it open for traffic. There is also the value of decreasing turbidity of the river from the fishing and recreational point of view, which can not be expressed monetarily but is great.

## Sedimentation at Chicago's South District Filtration Plant

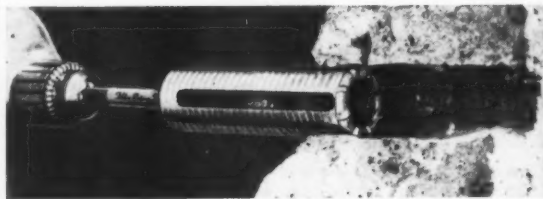
Settling basins play an important part in the operation of a filter plant. John A. Baylis, Chicago's Engineer of Water Purification, says: "If turbidity of 2.0 in settled water produced a certain length of filter run, whether it be 10 hours or 30 hours, the same water settled to a turbidity of 1.0 will produce filter runs nearly twice as long. If cost of construction were not a factor to be taken into consideration, settling basins would be designed for 12 to 24 hours settling time. Taking cost into account, designing engineers generally arrive at a settling period of 3 to 5 hours as being most economical.

"Settling basins not equipped with continuous sediment-removal devices generally are cleaned two to three times yearly, although the basins in a few plants are large enough to require only one cleaning each year. In other plants, four or more cleanings are required annually. One cleaning per year is desirable regardless of basin capacity or the amount of sediment accumulated. For most plants not provided

with continuous sediment removal, two cleanings per year are desirable. Should three cleanings per year be required it still may not be economical to have larger settling basins. However, if more than three cleanings are required, larger settling capacity most likely would be economical."

The basins of the South District plant were designed to give a settling time of 3.6 hr. at 320 mgd. Each basin is 138 ft. wide and 500 ft. long. Drag scrapers remove the sediment from the 160 ft. nearest the inlet end, where more than 50% of the sediment is deposited. These scrapers are operated daily. The sediment from the other 340 ft. is removed twice yearly by draining the basin and flushing with hoses to a sump, from which it is pumped to the lake. The cost of removing sludge per million gallons passing through the basins in 1949 was 3 cents for labor, 1 cent for pumping sludge and water used for flushing, and 1 cent for power to operate the scrapers and maintenance of them.

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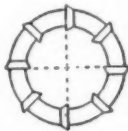
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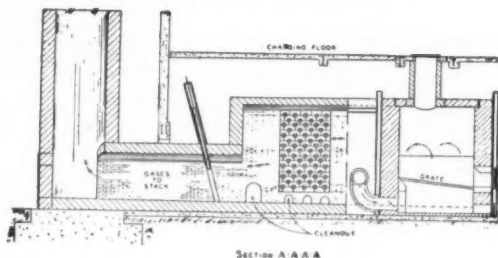
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## PUBLIC WORKS DIGESTS

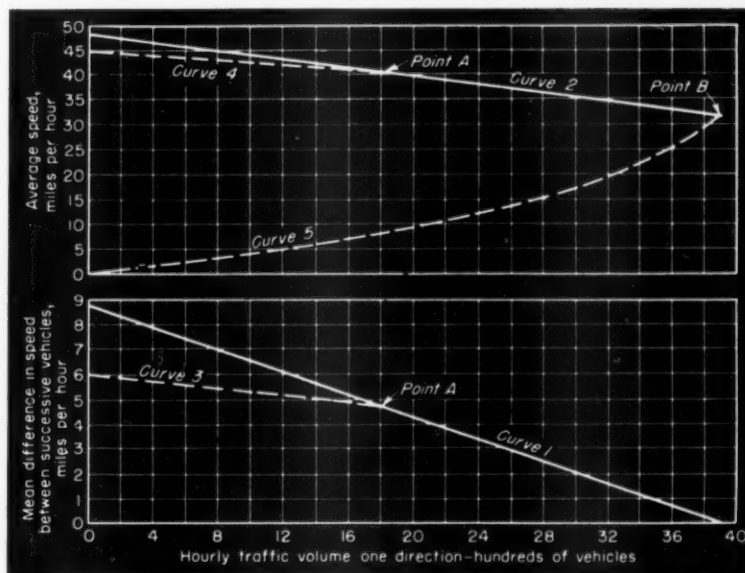
### Cost of Highway Construction

The California highway construction cost index has dropped from a high of 216.8 for the first half of 1948 to 195.7 for the second quarter of 1949. The decrease appears to be due chiefly to the increase in labor productivity, decrease in material prices, and elimination of many of the elements of uncertainty, including availability of materials at guaranteed prices and greater stability of the labor supply. The greatest decreases in average contract prices have been 23% in roadway excavation, 12% in Class B cement concrete pavement, 12% in bar reinforcing steel and 24% in structural steel. "It is our belief that no definite or accurate predictions can be made at this time as to future cost trends."

Richard H. Wilson, Henry C. McCarty and Richard R. Norton—"How High Costs Affect the Highway Program"; PUBLIC WORKS, September.

### Designing Highways For Future Traffic

Extensive studies conducted by the Bureau of Public Roads on the actual habits of drivers have furnished data that permit more technical designing of the geometrical elements of highways to provide maximum capacity and safety. These take into account the way in which people actually operate their vehicles rather than how they should operate them. It is believed that, although average speeds on our main highways will continue to increase, the increase will result from a reduction in the number of vehicles traveling at the lower speeds rather than an increase in the top speeds. On most of our main rural highways individual speeds range from 21 to 62 mph, with 12% exceeding 50 mph and 32% traveling less than 40 mph. On highest-speed highways of modern design and no speed limitations, 40% drive over 50 mph and 17% slower than 40 mph; very few exceed 60 mph. There is a great need for rural highways that will safely accommodate speeds up to 70 mph during light traffic density, and 45 to 50 mph during all but a few peak volume periods of the year.



Courtesy Engineering News-Record

● ON A 4-LANE highway: Curve 1—relative freedom from congestion in terms of differences in speeds between successive vehicles. Curve 2—average speed for all vehicles. Curve 3—speed differences at 50-mile limit. Curve 4—effect of 50-mile limit. Curve 5—slowest speed at which vehicles can attain various hourly flows.

On a 2-lane highway, as traffic volume increases, there is a uniform decrease in average speeds until, at a volume of 2,000 vehicles per hour the average speed is that of the slowest group of drivers; while operating conditions are not satisfactory if the volume exceeds 800 vehicles, of which 10% are trucks and buses. At a total traffic volume of 200 vehicles per hour, a 70 mph driver can average 61 mph; at 550 vehicles, only 51 mph. A 60 mph driver can average only 54 mph when the traffic volume is 400 vehicles. At 1,000 vehicles per hour, a 70 mph driver can travel no faster than a 50 mph.

On a 4-lane divided highway, the two lanes in one direction have a limit of capacity of 3,850, when they must travel at the speed of the slowest drivers. With a flow of 1,200 vehicles per hr. the normal speed would average 43 mph.

The practical capacity of a 4-lane divided rural highway is 1,000 passenger cars per hr. for each lane, with a safe average speed of 45 to

50 mph. Such a highway will accommodate  $3\frac{1}{2}$  to 5 times as much traffic as a good 2-lane, and the accidents will be less than half the number that may be expected on the narrower road.

To reduce accidents on rural 2-lane highways, stopping-sight distances 20 to 30% longer than those used in the past must be provided, or 1500 to 2,000 ft. With this distance available throughout the length of a 2-lane highway, the capacity of 45-50 mph traffic is 900 passenger cars per hr., but if this be available over only 40% of the length, the capacity falls to 720 cars; and with 50-55 mph speeds the capacity is cut from 600 cars to 420.

Other desirable features of geometric design are wider traffic lanes; more adequate clearance to retaining walls, bridge piers, etc.; wider all-weather shoulders; fewer intersections at grade; better control of access; and more effective signing.

O. K. Normann—"Fitting Highways to the Driver"; *Engineering News-Record*, September 1.

## Two-Way Radio For County Roads

The Delta County, Mich., Road Commission finds that a frequency-modulation two-way radio system "has contributed more toward the rejuvenation of the commission than any other one piece of equipment purchased in the past 20 years." The 1170 sq. mi. of the county is effectively covered by seven 50-watt mobile units, with a 250-watt headquarters station. Its greatest value lies in the handling of day-to-day administrative details rather than in emergencies. When a snow plow breaks down it takes an average of 19 min. to send help instead of 1½ to 2 hrs. as before.

William J. Karas—"Radio System Steps Up Efficiency"; *Better Roads*, July.

## Air Entrainment On Ohio Highways

Ohio's first highway pavement built entirely of air-entraining concrete was constructed in 1942 in an effort to obtain better resistance to salt and to freezing and thawing. Every year since then has seen others built and by Jan. 1, 1949 over 400

lane-miles had been built. Mean-time specifications have undergone several changes. At first they required that the cement be ground with an amount of Vinsol resin which would cause a reduction in the unit weight of the concrete of 4 to 8 lb. per cu. ft. All contracts since Jan. 1, 1947 required that the concrete have an air content of 3 to 6%, that Vinsol resin be neutralized when used as an interground air-entraining agent, and that the cement contain  $16 \pm 4\%$  air in standard mortar. Ohio has followed the lead of the A.S.T.M. in adopting the  $18 \pm 3\%$  entrained air limit in its specifications, but the final control is 3 to 6% limit on air entrained in the concrete. These revisions have resulted in improvement in the durability of concrete pavements in Ohio.

In 1945 and in 1948 the Ohio Highway Dept. and the Portland Cement Assn. made cooperative inspections of the surface conditions of all air-entraining concrete pavements in Ohio. In 1945 they found that, of 59 projects, 35 had scaled to some extent, but only slightly; the most scaling appearing on a project where emulsified carbon black had been added. Serious scaling was found on other projects built without air en-

trainment. These inspections indicated that the scaling of pavements built since 1944 was only about one-fifteenth as extensive as that of pavements built before that date, due chiefly, it is believed, to the increased amount of air entrainment used. It is believed that it is immaterial whether the agent be added at the cement plant or at the job if a minimum of 3% air be entrained in the concrete. Wherever air entrainment on any construction job falls below 3%, corrective measures are taken immediately. Variations in aggregate gradation and particle shape, cement characteristics, temperature of mixture during mixing, quantity of mixing water, and mixing time all influence the amount of air entrained in the concrete.

R. R. Litchiser and J. F. Barbee—"Air Entrainment Decreases Scaling on Ohio Highway Pavements"; *Civil Engineering*, September.

## Road Fill On Salt Marsh

In building 12.8 mi. of highway at Brunswick, Ga., 9.5 mi. had to be built across a salt marsh, the muck of which had a maximum depth of 36.5 ft. down to firm sand. All muck was removed and replaced with sand

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to a bottom width of 40 to 150 ft., a total of 2,393,280 cu. yd. of muck being removed by hydraulic dredges and pumped to points 600 to 900 ft. away. The muck slid back into the opened trench to side slopes of 3:1 to 5:1, requiring overcuts of 25% to 80% to give the necessary bottom widths. Sand for fill was placed hydraulically in two lifts; the first taking it elevation + 11. Then, using draglines, a broad depression was made in the center of the embankment between dikes raised to elevation + 18, then sand was pumped between the dikes and was leveled off to + 16 for a width of 44 ft., with side slopes of 10:1. On this is placed 3" of selected materials to stabilize the road bed, and on this 7" of limerock stabilized roadbed rolled to 100% compaction, followed by a single bituminous surface treatment, with liquid seal.

"Building Salt-Marsh Roads in Georgia"; *Engineering News-Record*, Aug. 25.

#### Michigan Gravel Pit Inventory

Michigan State Highway Dept. in 1935 began making a card index giving the location of gravel pits in the state and the characteristics of

the gravel. So many requests for these data were received that since 1940 they have been published annually in a multigraphed book. The 1949 edition contains data on more than 2,000 pits throughout the state. It is mailed to Michigan contractors, other road and street organizations, and interested state highway department personnel. The data are compiled by counties. Each pit is given a number, its location described by township and range line and with reference to the access routes. They include the year the test was made; the abrasion loss by Deval test or Los Angeles test; the percent of soft or non-durable particles; and quantity passing the No. 200 sieve. Users are warned that the tests may not apply to material now remaining in the pits. When any one opens up a new gravel pit, the state takes samples and gives the owner a description of the material. Preparations are being made to explore for material deposits by the electrical resistivity method, and personnel for it are being trained at the state highway testing laboratory.

In addition to the inventory, the department has prepared county maps on which are plotted the locations of all listed pits, main local

highways, township lines, and other data that will help locate the pits. The type of material in each pit and the abrasion loss are indicated by symbols (R G = road gravel; C A = coarse aggregate for concrete; A = 0 — 17% abrasion loss, etc.).

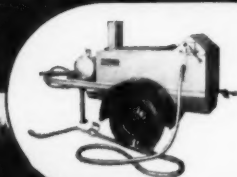
"Gravel Pit Inventory Helps Both Engineers and Contractors in Michigan"; *Roads and Streets*, August.

#### Bridges for Local Roads

On roads carrying less than 100 vehicles a day it is often possible to reconstruct old bridges, utilizing piers, abutments and superstructures although not up to desirable widths and capacity, sometimes providing new floors and steel stringers. But no one-way bridges should be retained if traffic exceeds 100 vehicles a day. It is often economical to utilize only the substructures, on which new superstructures of steel or concrete are placed. Bridges of concrete or steel on secondary rural roads should be designed to carry at least one lane of H 15 loading at any position. Building a new one-lane bridge is seldom justified. Timber trestles should be used only on light-traffic

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roads, where design is held down to H 10. On trestles, plain timber plank floors are the poorest; timber stringers with laminated 2 x 4-in. deck are preferable, with bituminous mat surfaces. For the average bridge of 25 to 80 ft. span, simple steel beam spans on pile bents or piers are the most economical at present prices. For spans up to 30 ft. the reinforced concrete slab type is economical. Prefabricated reinforced concrete and prestressed concrete constructions are being promoted.

For foundations, where the stream carries little drift or ice, and its bed is of material into which piles can be driven to sufficient depth, it is safe to provide open bent type construction, using piles of treated timber, reinforced concrete or steel. Treated timber piles with reinforced caps are quite generally used and have a life expectancy of about 20 yr. Precast concrete piles are good but very expensive. The most popular pile for low-cost construction is the steel H-beam, especially for point bearing; for friction support it does not have as great load-carrying capacity per dollar of expenditure as does the precast concrete. The advantages of both these types are

combined in the concrete-filled steel tube pile of heavy wall section.

Streams having a swift current carrying ice and drift call for piers or bents with solid walls, whether the bridge be for the heaviest traffic or a farm-to-market road. If steel bent construction be used, a wall connecting the piles should be provided from low to high water levels. The wall-type pier is economical and satisfactory, especially for long spans; it consists of a wall of reinforced concrete supported on piles spaced about 2 ft. 6 in. apart and extending from low water level to the bridge seat. The conventional masonry type abutment with wing walls is usually uneconomical; ordinarily the spill-through abutment of driven pile or footing type is cheaper and more satisfactory.

E. L. Erickson—"Stream Crossings for Local Roads"; *Better Roads*, August.

#### Aluminum Highway Bridge

In the *Highway Digest* for September, 1948, we published a brief note about an all-aluminum highway bridge being constructed across the Saguenay river, Quebec. Further information was given in a paper

by the designer before the recent meeting of the Engineering Institute of Canada. The use of aluminum was adopted because it was located in the heart of the aluminum industry in Canada. It was expected that the first cost would be greater than that of a steel one. This, however, will be more or less offset by lower maintenance costs. The bridge is an arch with 290 ft. span, 47½ ft. rise, with two box girder arch ribs spaced 23 ft. centers. The roadway is an 8" poured-in-place concrete slab 24 ft. wide between curbs. The structural alloys used are heat-treatable wrought alloys. The structural shapes are formed by extrusion; the plates are rolled, being first placed between two sheets of pure aluminum and the three rolled together, producing a plate consisting of an alloy core coated with pure aluminum to resist corrosion. Aluminum has a modulus of elasticity and weight about ⅓ of that of steel, and a thermal expansion about twice that of steel or concrete. Because of the latter, the bridge will have a total contraction, with a temperature drop of 100°, about 3" greater than the concrete floor slab; therefore it was decided to prevent relative movement between floor and supporting members

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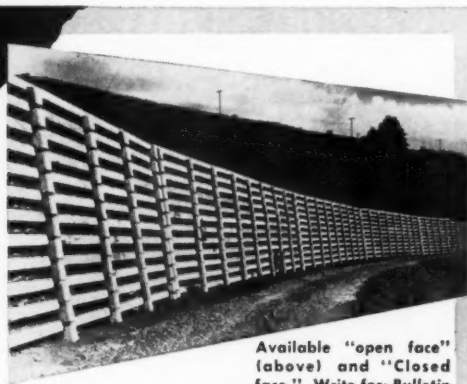
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by anchoring them to each other, subjecting the slab to a compression which it can take easily. The bridge will not be painted but contact with any concrete is prevented by use of bituminous paint on the tops of all floor members.

C. J. Pimenoff—"All-Aluminum Highway Bridge at Arvida, Que."; *Roads and Bridges*, August.

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### American Society for Testing Materials Bulletin

A Direct Reading Portable Photoelectric Photometer for Determining Reflectance of Highway Centerlines. By John M. Hill and Howard W. Ecker, Minnesota Mining & Mfg. Co. July, Pp. 69-72.

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Stream Crossings for Local Roads. By E. L. Erickson, Chf. Bridge Div., B. P. R. August, Pp. 21-22, 34.  
Room for Flatter Backslopes. Replies from several counties to a Forum question. August, Pp. 23-24, 35.  
Don't Neglect Highway Drainage. By A. M. Goodman, N. Y. State College of Agriculture, August, Pp. 31-33.  
Culvert Backfill Compaction Requirements, August, P. 33.

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Cost Index on California Highways. By Richard H. Wilson, Henry C. McCarty and Richard R. Norton, engineers with California Div. of Highways. July-August, Pp. 1-2.

The Design of Seal Coats and Surface Treatments. By F. N. Hveem, W. R. Lovering and G. B. Sherman, engineers with California Div. of Highways. July-August, Pp. 312.

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Air-Entrainment Decreases Scaling on Ohio's Highway Pavements. By R. R. Litchiser and J. F. Barbee, Chf. Engr., and Engr., Testing Lab., Ohio State Dept. of Highways. September, Pp. 32-33, 92.

Concrete Arch Carries Sharply Curved Highway Over 70-ft. Ravine. By C. H. Darby, Sr. Br. Engr., Calif. Div. of Highways, September, Pp. 38-39.

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A New Runway Expands Phoenix Municipal Airport. August, Pp. 43-45.

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What Authority Have Highway Departments in Urban Municipalities. July, Pp. 50-51, 74.  
All-Aluminum Highway Bridge at Arvida, Que. By C. J. Pimenoff, Dominion Bridge Co. August, 57-61, 96.  
What Is the Anticipated Life of Various Road Surfaces? By Fred B. Farrell and Henry R. Paterick, B.P.R. August, Pp. 64-68, 110.

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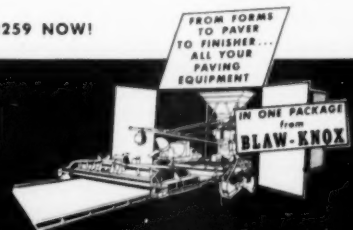
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## PUBLIC WORKS DIGESTS

# THE WATER WORKS DIGEST

### Water for the Carbonated Beverage Industry

The soft drink industry uses approximately 6,250 million gallons of water a year. Water satisfactory for a domestic water supply may not be so for bottling purposes, for which there is a threshold for alkalinity, clarity is a critical factor, and taste and odor are not permissible. If there is sufficient alkalinity in the water to neutralize the first hydrogen-ion of the citric or phosphoric acid used in the beverage, the tartness of the beverage is lost; in a beverage containing phosphoric acid, the tartness is seriously affected when 170 ppm of alkalinity is present, and below 85 ppm is desirable. Water that appears to be clear may contain finely divided solids, which cause foaming during bottling. Organic matter may cause flocculation or sedimentation of some of the components of the beverage. Excessive hardness may precipitate in the bottle-washing solutions. The map shows the zones of alkalinity of the water received by bottling plants throughout the country.

To insure the desired quality of the water used, it is treated at the bottling plant by coagulation and chlorination, with alkalinity reduction by lime treatment when needed; sand filtration, and activated carbon. All oxidizable organic matter must be completely removed, for which purpose chlorine is used. In hardness reduction, only the carbonates need to be removed. A method of treatment applicable to all usable waters which is in general use is the ferrous sulfate-lime-chlorine. Normally a dosage of approximately 35 ppm of ferrous sulfate, and chlorine residuals of 6-8 ppm are employed. Lime is added as a slurry, sufficient to maintain the relation: two times the phenolphthalein alkalinity minus the total alkalinity equals 0.2 — 0.7 phenolphthalein. The presence of vitreous phosphate in water gives considerable trouble in conventional lime treatment, but does not interfere when ferrous sulfate is used. Excessive hardness of water used for washing bottles may cause cloudi-



Courtesy Journal AWWA

● **WATER FOR the carbonated beverage industry—not a futuristic nightmare, but a very present reality. This map shows the zones of alkalinity of waters received at bottling plants.**

ness of the bottles or scale formation in the bottle-washing machines. Separate treatment of washing water is effected in some plants by sodium zeolite softening.

Bert H. Wells—"Water for the Carbonated-Beverage Industry"; *American Water Works Assn. Journal*, September.

### Olympia, Wash. Water Supply Items

Artesian wells supplying Olympia were frequently broken by the shifting of sand strata above hardpan through which the wells passed. As a substitute for wells, the city has obtained its supply from springs flowing 20 to 30 mgd. The water is pumped to a 2 mg reservoir lined with reinforced concrete. To prevent birds landing on this reservoir, a wire grid was constructed above the water surface, using No. 6 hard drawn copper wire anchored to the concrete walls of the reservoir; 12" being allowed between the upper and lower cross wires. Water is taken from this reservoir to two distributing reservoirs by a 36" concrete pressure pipe, which, at highway

crossings, was threaded through a 42" reinforced concrete culvert pipe; under railroad tracks, steel pipe embedded in concrete was used. The water level in the reservoirs is controlled by means of a 16" cone valve which has a closing period adjustable within a range of 1 to 8 min., combined with a control device adjustable through at least 5 steps which automatically vary the opening of the cone valve, increasing it as the water in the reservoir falls and vice versa.

Henry G. Porak—"How Olympia Got a Better Water Supply"; *PUBLIC WORKS*, September.

### Poliomyelitis Transmission by Water

The only known natural sources of the causative virus of poliomyelitis are the oropharyngeal secretions and fecal excretions of infected human beings. It is an established fact that the principal mode of communication of poliomyelitis is some form of personal contact. This, however, does not preclude the possibility that accessory and indirect routes of spread may be operative under

special circumstances. Four such possibilities have been extensively explored: (1) the existence of an extrahuman reservoir of the virus; (2) the role of flies as vectors; (3) dissemination by contaminated milk; and (4) by polluted water. Up to the present, attempts to demonstrate the virus in suspected drinking water supplies are questionable or negative. It is unknown whether, if present in raw water at the intake of a surface supply, it would be removed by the successive stages of treatment necessary to produce a potable product which is safe by bacteriological standards. However, free residual chlorine as customarily practiced affords an adequate safeguard. There is no instance on record up to the present in which convincing evidence has been presented that pollution of a community water supply was responsible for indirect and widespread exposure of consumers to infection with the virus.

Kenneth F. Maxey—"Supposed Involvement of Water Supplies in Poliomyelitis Transmission"; *Am. Water Works Ass'n Journal*, August.

#### Fluoridation of Public Water Supplies

This is a statement prepared by a special committee of the A.W.W.A. and approved by the Board of Directors of the Association on May 29, 1949. Epidemiological studies of the relationship between fluoride occurring naturally in water supplies and the prevalence of dental caries have demonstrated that the presence of 1 to 1.5 ppm of fluoride is associated with a 50-65% reduction in caries prevalence. But all epidemiological evidence is presumptive, and its value depends upon the amount and kind of scientific data which support or refute the hypothesis. Such data are now being collected by actual application of fluoride in a number of cities; satisfactory conclusions from which will not be possible until the experiment has been maintained for 8 or 10 years. Therefore the policy recommended is as follows:

In communities where a strong public demand has developed and the procedure has the full approval of the local medical and dental societies, the local and state health authorities, and others responsible for the communal health, the water departments or companies may properly participate in a program of fluoridation of the public water supplies.

The cost of fluoridation will probably range from 5 to 15 ct. per capita per year. This should be

charged, not to the cost of water-works operation, but against commercial health activities.

"The Fluoridation of Public Water Supplies"; *American Water Works Ass'n Journal*, July.

#### Insufficiency of Records in Small Plants

Experience with 80 small water supplies in Illinois indicates that inefficiency of operation, non-existent records or inept methods of record keeping are, in many instances, depriving the municipalities of revenues and also of data that might

justify increase in rates. Data obtained from 44 of the Illinois plants show that only 5 meter their pumpage; only 14 have universally metered services; few have any fair basis upon which to compute per capita costs, revenues and rate structures. Only 11 have determined the overall efficiency of pumps and motors within the last five years. Every plant should have a record of total daily pumpage, aided by use of a master meter, and of total daily consumption, obtained by 100% metering. The efficiency of pumps and motors should be investigated



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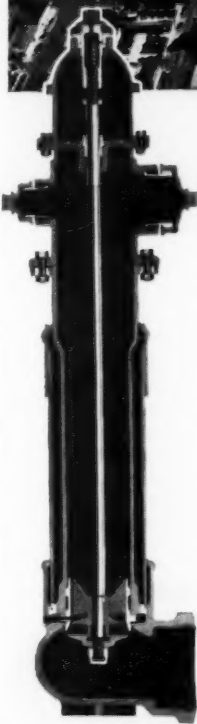
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before any contemplated rate increase is made. In the case of well supplies, periodic water level readings and yield-drawdown characteristics should be recorded.

R. H. Harmeson—"Why Increase Water Rates"; *PUBLIC WORKS*, August.

### Expansion of the Kalgoorlie Supply

Western Australia has very little rainfall, and in 1900-1902 the government, to supply water to the recently opened goldfield and the settlements that started around it,

built a 346-mile line of 30" steel pipe to bring water from a dam, known as Mundaring weir. The demand now greatly exceeds the capacity of the old system, and this is being increased by raising the Mundaring dam 32 ft., thus increasing the storage capacity from 4.6 to 15.1 billion gallons; and adding mains and additional pumping capacity by stages. Also another dam is to be raised to add 30.5 more billion gallons storage for another dry area.

An interesting feature of the plan is the raising of Mundaring weir. The new concrete is being built in

5-ft. lifts placed at intervals of not less than 5 days, to minimize the heat developed. Slots 3" deep are provided in the new concrete next to the surface of the old, and between adjacent blocks, and filled with coarse-graded aggregate. Later, when the new concrete has become stabilized, there will be injected into the slots under pressure a grout of cement and flue ash and a small quantity of aluminum powder, which will develop very little heat and shrinkage.

H. Bowden Fletcher—"Remodeling a West Australian Water Supply System;" *Water Works Engineering*, July.

### Prechlorinating a Slow Sand Filter

A slow sand filter plant, the Whitney filter plant, was placed in operation by the New Haven (Conn.) Water Co. in 1905. The beds were cleaned by scraping about  $\frac{1}{2}$ " of sand from the surface at intervals. The lower levels of sand and gravel have not been cleaned since the plant was first placed in operation. As labor became more expensive, methods of reducing the number of filter scrapings were considered, and experiments with prechlorination were run during 1947 and 1948. As a result of these, it was found that prechlorination increased filtering capacity, moderate dosage rates to give free-residual chlorination of the raw water increasing the output 72% without disturbing the physical characteristics of the water. Cleaning of the sand in this way was very slow; it was more rapid when higher dosage rates were used, but these necessitated waste of the unpalatable effluent for about 2 months. Two filters (of the 12 in use) were cleaned in this way, using approximately 0.15 lb. of chlorine per cu. ft. of sand, and showed 100% and 233% increases in capacity. During prechlorination there was gradual removal of dirt from the 45-yr. old sand and gravel and gradual improvement in the effluents bacteriologically, but not in taste, odor or appearance.

Samuel Jacobson and Marshall S. Wellington—"Introduction of Prechlorination of Slow Sand Filters;" *New England Water Works Ass'n, Journal*, June.

### Cement Joints For Water Mains

Los Angeles, Calif., began using cement joints in 1894 and has more than 4,000 miles of cast iron water mains calked with cement. Of 23 Pacific coast cities, 19 regularly use



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cement joints, except that lead is used in filled ground or for quick jobs, and, in a number of cities, to provide an expansion or flexible joint at intervals of about 500 ft. Cement joints have been used by Des Moines, Ia., Miami and Palm Beach, Fla. and several other cities.

If the temperature of the pipe falls below that when the joints were made, the pipe line is subjected to considerable tension, since there is no "give" to the joints, and there have been a number of instances of breaks in such pipe lines near the ends of extremely cold seasons, where there were no expansion joints at intervals. In 1932 a cement joint could be made for 1/5 of the cost of a lead joint; at present the ratio is about 1:7. Miami, Fla., used cement joints from 1932 to 1942 in laying 75 miles of pipe, but in 1942 changed to sulfur-compound joint material to cut down the cost of labor.

In using cement joints, the pipe should rest solidly in the trench bottom, with the spigot solidly home in the bell, and the pipe prevented from moving by a small amount of backfill; and no joint calked until 5 or 6 lengths of pipe have been laid beyond it. The cement should be mixed thoroughly with the proper amount of water—16% by weight seems to be the optimum—and calked into the joint so hard as to give a ringing sound like metal, and covered with moist earth or wet sacking. It is beneficial to fill the pipe with water after four hours, but no pressure should be put on until the joints have set for 16 hr. or more.

Dale L. Maffitt, Laurence E. Goit and C. F. Wertz in a panel discussion—"Cement as a Jointing Material"; *American Water Works Ass'n Journal*, July.

#### Calgon for Corrosion Control

Calgon is a glassy phosphate, also referred to as metaphosphate or sodium hexametaphosphate. A strong solution is corrosive to most metals but dilute solutions are not. Its main use is for corrosion control; but it is also used for iron control of well waters, and to prevent the laying down of calcium scale by hard water. In corrosion control it forms a film only one or two molecules thick, never any thicker, and distributed uniformly throughout the pipe system. In adjusting the rate of dosing of Calgon, this is determined by the area of surface to be protected and not by the quantity of water flowing through the system. The rate should

be such as to insure having 0.55 ppm of unverted phosphate in the water at the ends of the system. The film will not be formed in a distilled water system, unless calcium salt be added to it; the calcium content of the water must be at least 1/4 that of the Calgon concentration. Excellent results can be obtained with pH values as low as 5.0. For control of iron in domestic supplies, Calgon concentration of at least twice the iron and manganese is advisable, and four times when a minimum of color in the hot water is desired. In

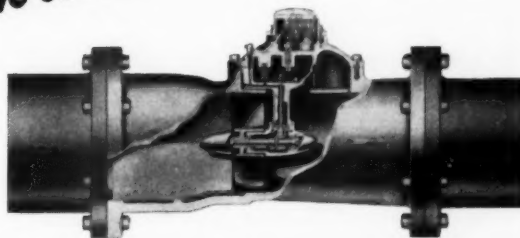
a number of domestic supplies an iron content of 0.5 to 1.0 ppm is maintained in solution.

John H. White—"Corrosion Control by Threshold Treatment"; *Water & Sewage Works*, September.

#### Water Supply in the Chicago Metropolitan Area

While municipalities bordering on Lake Michigan have an unlimited source of supply from the lake, those inland which depend on well water find the level of this continuously receding and the demand ex-

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ceeding the available supply. The logical and economical solution of their problem is to come to the lake for their supply; and, to reduce the cost and avoid duplication of intakes and treatment plants, to combine into as few units as possible. The effecting of such combinations is delayed because of the difficulty of unifying the desires of the numerous communities involved and the desire of each to avoid domination by a larger political agency. Oscar E. Hewitt, Commissioner of Public Works of Chicago, believes that the

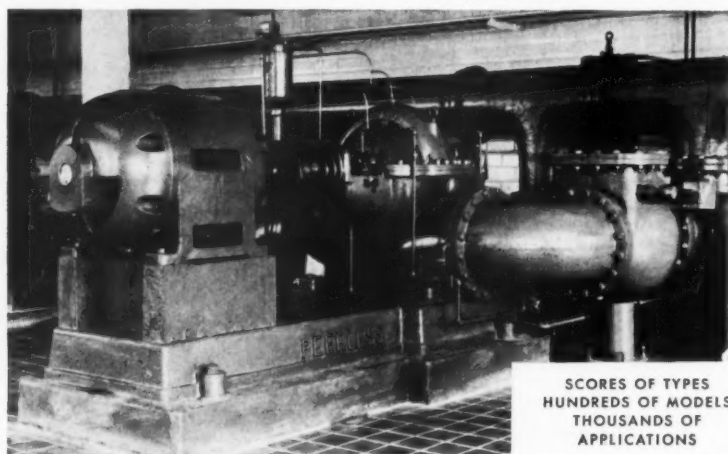
answer for the municipalities within a radius of 40 miles of Chicago's center is to extend the Chicago water supply system to cover that area. This area would extend from Waukegan, Ill., on the north to Gary, Ind., on the south, and to Elgin and Aurora, Ill., on the west, and would include 168 incorporated cities, towns and villages, and 25 unincorporated villages. The total population of this area in 1940 was 4,799,250, of which 3,396,808 lived in Chicago. That city at present supplies Lake Michigan water to 45 towns with a 1940 pop-

ulation of 398,215; and 15 municipalities obtain lake water through their own intakes. To bring lake water to all those in this area not now receiving it would mean supplying about 400,000 additional consumers.

To carry out this plan, it is proposed to divide the system into three major zones—NW, W and S. The NW would require three booster pumping stations; the W zone, two booster stations; and the S zone, a reservoir and a booster station.

Loran D. Gayton—"Water Supply Problems in the Chicago Metropolitan Area"; *Am. Water Works Ass'n Journal*, August.

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**Trends of Population**

Intelligent development of water resources and plants involves the estimating of future populations. The general practice has been to use as a basis the past rate growth of the city or other unit and project this into the future, considering the history of other cities with similar characteristics. But population trends since 1940 indicate that less confidence can be placed in this method than heretofore. Comparing 1948 estimates with 1940 census figures, the Census Bureau finds a great increase in population, less than 10% of which was due to immigration, the other 90+ being due to high birth rate and decline in death rates. Mortality rates are already very low and can not be expected to go much lower. Whether the high birth rates will continue, and for how long, is anybody's guess. The Census Bureau does not expect the 1940-1948 rate of increase of population to continue.

Even more important to individual municipalities and to the utilities that serve them is the movement of the population within the country. During the 8-year period 30 states lost more than they gained by the migration of citizens. In 4 states the net in-migration was more than ¼ of the total population increase. Nearly ⅔ of the population changed their residence, about 20% going to another state. The rural-to-urban migration continued, about 4 million persons making this change. There is no evidence that these trends will continue indefinitely at the same pace. In fact, they may be reversed; a serious depression might reverse the trend of off-farm migration or of migration out of the South.

To a certain extent the number of families as well as the total population affects consumption of water and other utility uses. During the 8 year period the number of house-

holds increased at an average rate of 700,000 a year, but between 1930 and 1940 the rate was only 500,000. Between 1940 and 1948 the average population per household dropped from 3.67 to 3.49.

Howard G. Brunsman and Norman Lawrence—"Population Trends Since 1940"; *Public Management*, August.

### Water Main Extension Policy

The Committee on Water Main Extension Policy of the A.W.W.A. has reported its agreement on certain general principles which should be observed in formulating and administering water main extensions. These are that the policies should be nondiscriminatory and based upon business principles; and should assume that the main extensions will be self-supporting. The policies should provide for customer participation in the financing of extensions into localities within the utility service area where service is needed, if the anticipated revenue is insufficient to warrant the utility making the extension unassisted; and should be implemented by the adoption and promulgation of comprehensive rules which should be reviewed periodically.

The ownership of the main extension should be vested in the utility, which should have the right to make additional extensions from the initial extension without incurring an additional obligation to the extension promoter. The utility should be the one to determine the size of pipe to be used in the extension. The extension project should be charged only with a pipe of sufficient size to afford proper service in the area traversed by the extension. If the utility investment is not sufficient to pay for the entire extension, the promoter of the extension should be required to deposit with the utility an advance in aid of construction sufficient to pay for the portion which will not be paid for by the utility; which advance should be refunded as additional customers take service from the extension.

"Water Main Extension Policy"; *Am. Water Works Ass'n. Journal*, August.

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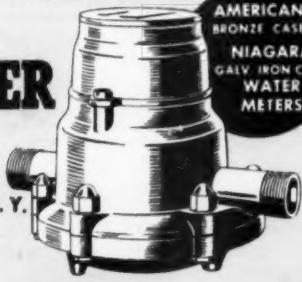
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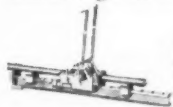
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Diatomite Filters for Swimming Pools. By John E. Kiker, Jr., Prof. of Public Health Eng., Univ. of Florida. September, Pp. 801-809.

Advantages and Limitations of Automatic Equipment. By Vance C. Lischer, Cons. Engr. September, Pp. 810-818.

Disposal of Softening Plant Wastes: Lime and Lime-Soda Sludge Disposal. By A. P. Black, Head, Dept. of Chemistry, Univ. of Florida. September, Pp. 819-828.

Brine Disposal from Cation-Exchange Softeners. By Paul D. Haney, San. Engr., U.S.P.H.S. September, Pp. 829-836.

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Cathodic Protection Notification Procedures. By Committee on Cathodic Protection. September, Pp. 845-851.

Joint Cathodic Protection Systems. By Committee on Cathodic Protection. September, Pp. 852-855.

Processing Water for Industry. By R. W. Haywood, Jr., Am. Viscose Corp., and Bert H. Wells, Coca-Cola Co. September, Pp. 856-864.

## Engineering News-Record

New Flow Meter Cuts Costs; Simplifies Installation Problems. By R. E. Tarring, Instrument Associates, Inc. Aug. 18, Pp. 36-37.

## Public Management

Population Trends Since 1940. By Howard G. Brunsmann and Norman Lawrence, U. S. Bureau of the Census. August, Pp. 218-221.

## Public Works

Cleaning Pipe Line Increases Capacity 92%. September, P. 28.

How Olympia Got a Better Water Supply. By Henry G. Porak, City Engineer. September, Pp. 31-32.

## Southwest Waterworks Journal

Diatomaceous Earth Filters. By Henry L. Dabney, Engr. Texas State Dept. of Health. September, Pp. 7-8, 26.

Water Conservation Policies. By Uel Stephens, Dir. Water Dept., Fort Worth, Tex. September, Pp. 9-10, 22.

## Water and Sewage Works

The Chemistry of Water Treatment: Some Unusual Problems. By A. P. Black, Head Dept. of Chemistry, Univ. of Florida. September, Pp. 325-329.

Emergency Procedure. By Sherman L. Rogers, Sup. of Distribution, Hartford, Conn. Water Bureau. September, Pp. 330-331.

Corrosion Control by Threshold Treatment. By John H. White, Chem. Engr. September, Pp. 339-340.

Ft. Worth, Tex., Makes Quick Comeback from Flood Damage. September, P. 350.

## Water Works Engineering

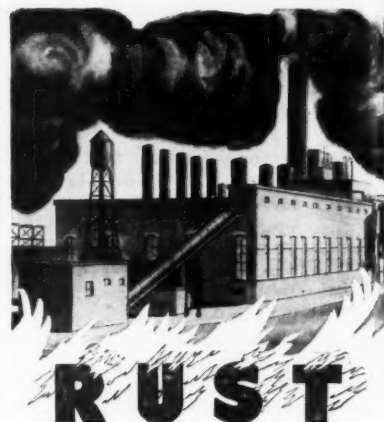
Conservation of Ground Water Resources, Nassau County, N. Y. By W. Fred Welsch, Sen. Engr., Div. of San. & Water Supply, Nassau County, N. Y. August, Pp. 709-710.

Pipe Cutting Machines. August, Pp. 721-722, 746.

Safety Factors When Repairing a Broken Water Main. By Angus D. Henderson, Civ. Engr., Dept. of Water Supply, New York City. August, Pp. 726, 749.

## HYDROLOGY

The extent to which this excellent book covers the field of hydrology is shown quite well by the following chapter headings: The hydrograph; the drainage basin; precipitation; water losses; infiltration; ground water; runoff; floods; and stream flow records. Procedures in application are explained in a helpful manner, such as how to determine the maximum flood flow likely at an airport. By C. O. Wisler and E. F. Brater; 419 pp., 132 illustrations; \$6; John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y.



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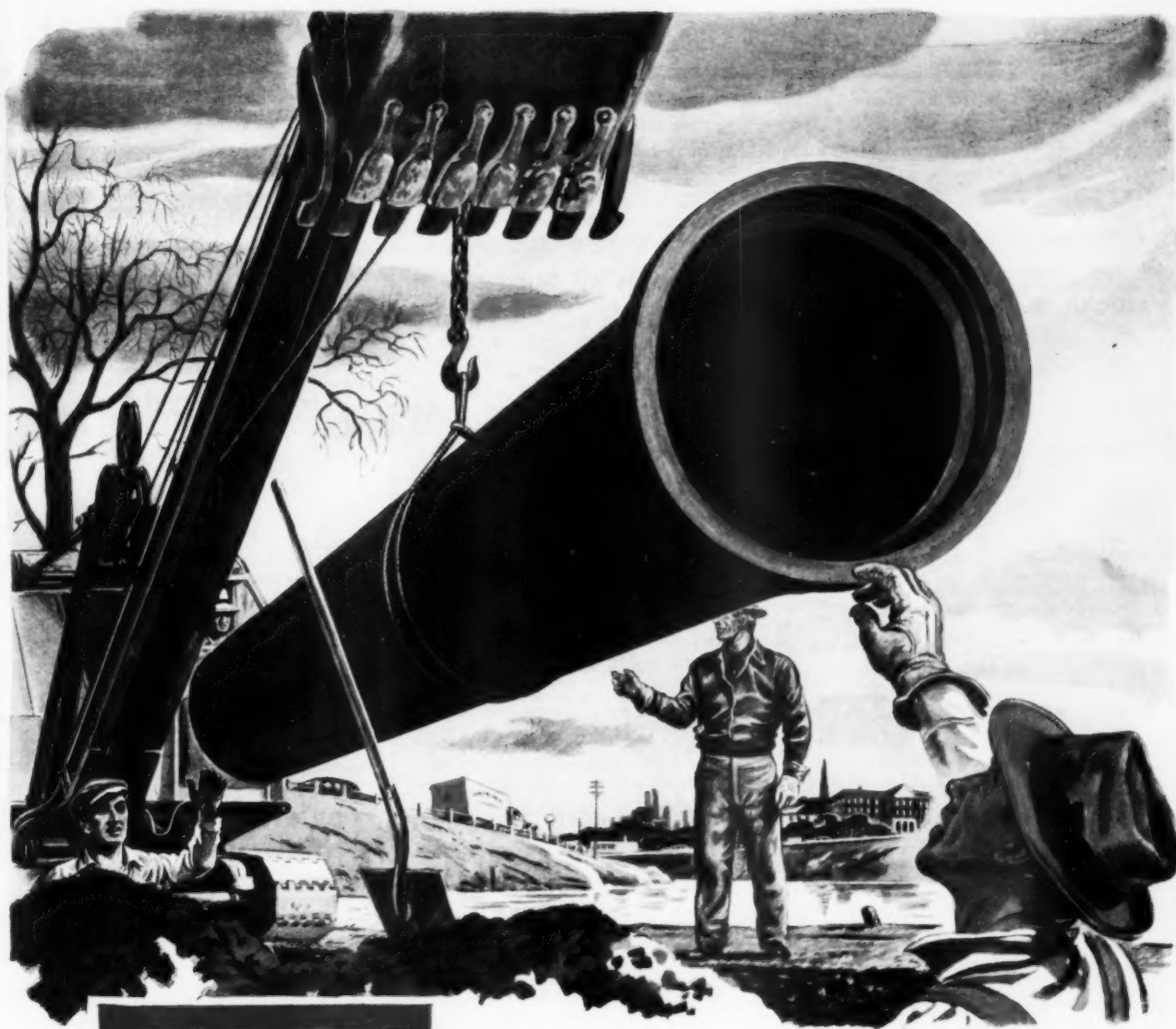
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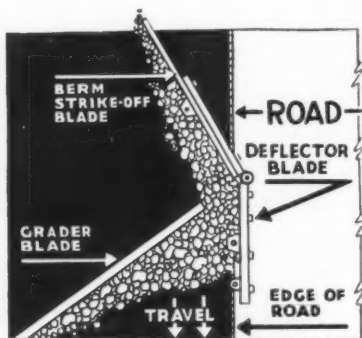
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# PUBLIC WORKS Equipment News

## To Reshape Worn and Dangerous Berms

Ruts, holes and washouts, where berms and pavement edges meet, are easily handled by this new berm shaper attachment. The illustration



**Takes out bumps.**

herewith shows how it works. The blade reshapes the uneven berm, the excess material is worked into the holes and the edge of the pavement is reshaped. Attaches to and works with the motor grader mold-board and circle. Strike-off blade angle is adjustable. Galion Iron Works & Mfg. Co., Galion, Ohio.

Use coupon on page 93; circle No. 10-1

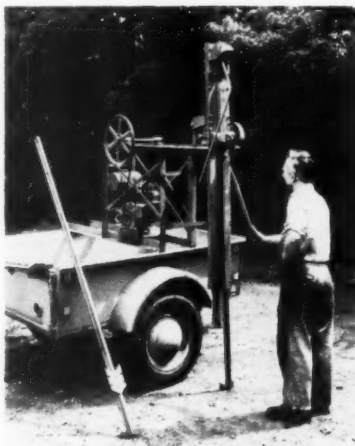
## Power Saw Weighs 33 Pounds

A chain saw, with chrome-plated chain, which weighs only 33 pounds, is said to be easy to handle and very fast cutting. There are straight blades in 14", 20", 27" and 30" sizes, and a non-binding bow saw. Write Homelite Corp., Port Chester, N. Y., for complete information or for a free demonstration.

Use coupon on page 93; circle No. 10-2

## Power Driver for Fence Posts

Two men, with this handy machine, can drive up to 150 or 200 standard steel posts, 5 to 8 ft. long, per hour—and without any mashed fingers. It is powered with a 1-cylinder gasoline engine, which uses a gallon of gas a day. The whole unit can be mounted on a truck or a small trailer and used most anywhere. It is specially useful for driving snow fence posts after the ground is frozen. It was designed by



**No mashed fingers.**

a former county engineer. Ask for data from Henrici Laundry Machinery Co., Henrici St., Mattapan, Boston, Mass.

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## For Better Highway Widening

A flat bottom, clean ditch of uniform width and depth, on which very little, if any, fine-grading is required, is obtained with this new widener. Digs to as much as 18" deep, and can remove such hard material as broken concrete. Cutting widths are 24" to 48"; digging speeds 2.7 to 29.1 ft. per minute. Ask for Bulletin 616. Gar Wood Industries, Findlay Division, Findlay, Ohio.

Use coupon on page 93; circle No. 10-4

## 97% Compaction; 1 Man Does the Work of 5

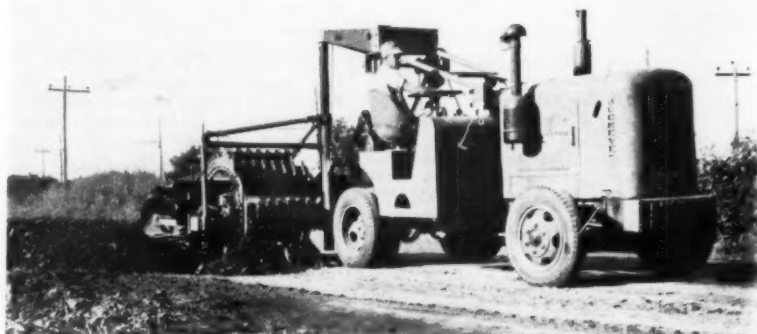
By actual tests, it has been shown that one man with the Barco Pegson rammer obtained a compaction of 97%, with lifts of 12 ins. to 20 ins.



**One man = five.**

on ditch refilling. This rammer is self-contained, gasoline operated. It runs 4 to 6 hours on one gallon of fuel. Excellent catalog. Ask for No. 620. Barco Mfg. Co., 1841 West Winemac Ave., Chicago 40, Ill.

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**Widening roads the easy—and faster—way.**

### A Digger to Reduce Hand Labor

This tractor-powered, hydraulically-operated power digger is intended to fill the gap between expensive hand labor and the heavier



For ditches, footings and trenches.

power excavating equipment. It will dig ditches, septic tank holes, footings, culvert trenches, etc., and is claimed to do the work of ten men with picks and shovels. It has a below the ground reach of 6 ft. Write Sherman Products Co., Inc., Royal Oak, Mich.

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### New Pumps by Marlow

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pumps are 4-inch and 6-inch, 3,000 to 14,400 gph; walking beam diaphragm and plunger pumps, 3-inch and 4-inch, are 3,000 to 9,000 gph. For full data, write Marlow Pumps, Ridgewood, N. J.

Use coupon on page 93; circle No. 10-7

### Small Vertical Shaft Engine

This VS (vertical shaft) engine develops 1½ horsepower or more, weighs 35 pounds, and is 4-cycle. Ignition is dustproof and waterproof.



24 pounds per horsepower.

For full information on this and five other Clinton engines, write Clinton Machine Co., Clinton, Mich.

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### The Newest Link-Belt Shovel-Crane

The LS-51 is a half-yard shovel-crane with full hydraulic variable pressure controls. It can be converted to trench hoe, lifting crane, dragline, clamshell or pile driver, and the changes can be made quickly. Full data are included in Catalog 2356, Link-Belt Speeder Corp., Cedar Rapids, Iowa.

Use coupon on page 93; circle No. 10-9



Half-yard, convertible, with full hydraulic controls.



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A. W. W. A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.



M & H furnishes both regular type A. W. W. A. fire hydrants and special Traffic Model designed to yield at the ground line under impact.



Valves & Hydrants  
Furnished Mechanical  
Joint When Desired

### M & H PRODUCTS INCLUDE—

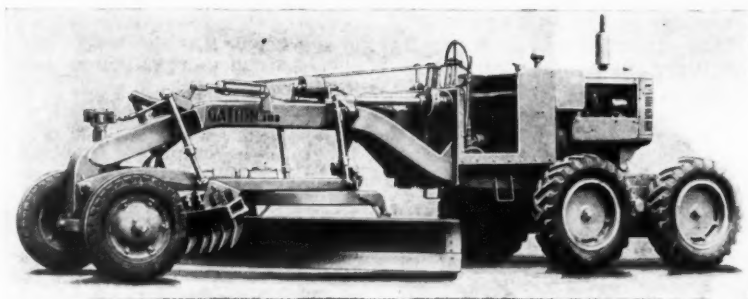
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Mud Valves  
Flap Valves  
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**M & H VALVE**  
AND FITTINGS COMPANY  
ANNISTON, ALABAMA

**Motor Grader for Limited Budgets**

This is a medium-duty grader, with 45-hp gas or diesel engine, and all-gear 4-wheel tandem drive or single drive. It weighs about 12,000 pounds. All operations are completely hydraulic, with blade adjustable 360° horizontally and 90° vertically. Standard equipment includes electric starter. Ask for data on the No. 303. Galion Iron Works & Mfg. Co., Galion, Ohio.

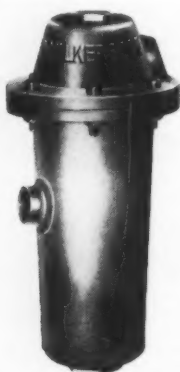
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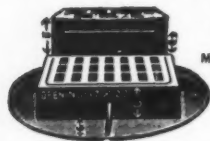
More results from limited budgets.

**Drain Valve for Compressed Air Lines**

Automatically draining off all water and oil in the compressed air line, together with dirt, rust flakes, dust and abrasive material, this air line valve protects equipment and



Wilkerson air line valve.

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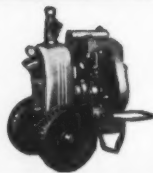
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saves air. It will handle up to 28 cu. ft. of air per minute at 100 lbs. There is only one moving part. Used on impact wrenches, pneumatic drills, hammers, riveters, screwdrivers and many other places. Description from Wilkerson Valve, Inc., 260 S. Dale Ct., Denver, Colo.

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There are many places where this 1-yard scraper can do jobs that are impossible with heavier equipment. It is especially useful on these small jobs, or as an accessory on large jobs in airport maintenance, grading and leveling, trenching, back-



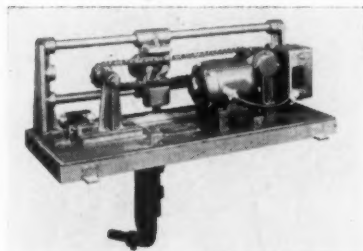
Many-purpose 1-yd. scraper.

filling, snow removal, building reservoirs and highway maintenance. It is also available in 1½-yd. capacity. Western Equipment Mfg. Co., Box 105, Glendale, Calif.

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By means of periodic samplings from a stream of moving material, this sampler gives accurate information on the quality of the product. It will operate at any desired time



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interval from 5 to 60 minutes and may be actuated by an automatic time switch. Full information from the Hardinge Co., Inc., York, Pa.

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Snow plow attachments, both V and reversible blade, are available for the 4-wheel drive, 1½-yd. Hough HM Payloader. The plows interchange readily with the usual bucket, and are operated by the same hydraulic controls that operate the bucket. Many other features are described in material available from Frank G. Hough Co., 867 Sunnyside Ave., Libertyville, Ill.

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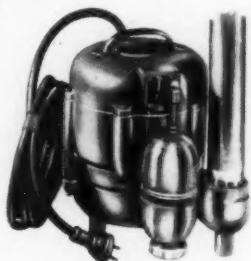
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### Alarm Silencer for Complete Circuit Protection

To eliminate the danger of forgetting to close hand-opened knife switches in alarm circuits, a new alarm silencer has been developed

which may be used with any type of electrical alarm circuit that indicates emergency conditions, such as pressure, liquid level, temperature, or overload. When an emergency arises, the alarm can be stopped by pressing a button, but a glowing red light remains on until the trouble is corrected. When the circuit is clear, the silencer automatically resets itself and the light goes out. Write Automatic Control Co., St. Paul 4, Minn.

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### New Features on High Lift Pull Grader

A combination leaning and steerable wheel; independent steering of both front and rear wheels; and an offset hitch which permits the trac-



**A grader with new features.**

tor or truck to remain on good ground, with the grader being steered laterally as needed, are features of this unit. Moldboard is 8, 9 or 10 ft. Weight is about 4,000 pounds. Gledhill Road Machinery Co., Galion, Ohio.

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### Truck Bodies for General Service

These truck bodies are strongly constructed, nickel-copper bearing alloy steel being used throughout.



**Truck bodies by Holan.**

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Use coupon on page 93; circle No. 10-18

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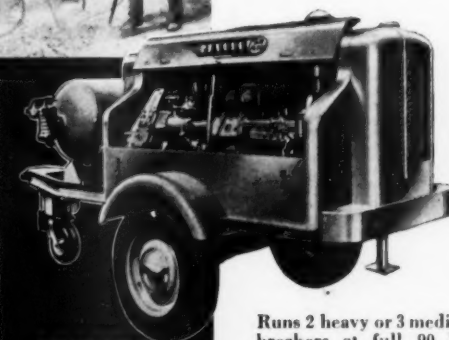
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## NEW LISTINGS

### Helpful Painting Chart For Sewage Plants

55. Specific data on surface preparation and priming, and a handy chart showing the proper type of paint for all surfaces and sewage plant conditions are included in new bulletin 586 published by Inertol Co., Inc., 480 Frelinghuysen Ave., Newark 5, N. J.

### Learn How Contractors Cut Concrete Costs

56. "Seven New Ways to Mix and Place Concrete at Lower Cost" is title of new Dumperette folder L-107. Application to a variety of construction jobs and data on plant set-ups are included. Copies from Dumperette Div., Maxon Construction Co., Inc., 131 N. Ludlow St., Dayton, Ohio.

### Pump Bulletin Helps Figure Head, Capacity

75. Maximum efficiency and lowest maintenance results from fitting pump to a particular job. Installations in water and sewage pumping stations are covered in Allis-Chalmers bulletin O8B6146A which describes single stage, double suction pumps, shows how to figure all factors in head and has many useful tables. Allis-Chalmers Mfg. Co., 1189 S. 70th St., Milwaukee, Wis.

### 60-page Liquid Chlorine Technical Bulletin

118. This 60-page, easy-to-read handbook completely describes the properties of liquid chlorine, shipping containers and safe handling procedures. A summary of all precautions and procedures in case of leakage or accident is printed in wall-chart form. For a copy of this bulletin, No. 7, write Solvay Sales Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

### Composite Water Well Supply Catalog

142. A new catalog, designed as a complete reference book, lists all the equipment necessary to drill and produce a well. Copies of this 110-page booklet are available through the Water Well Department, National Supply Co., Box 416, Pittsburgh 30, Pa.

### Reference Chart for Concrete Drilling

149. Compact reference chart quickly determines correct size of concrete drill bit to use for any given size of pipe, conduit, machine bolt or concrete anchor. Really useful for construction workers, installation and maintenance men. Copies available from Tilden Tool Mfg. Co., 1995 No. Fair Oaks, Pasadena 3, Calif.

### Complete Bulletin on Municipal Supplies

178. Everything from leak locators to street signs is listed in the big bulletin on "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included in this handy booklet. Get a copy for ready reference on all municipal supplies. W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

### Complete Water Softening Bulletin

169. The Lakeside Engineering Corp., has a 32-page bulletin on water softening which covers the theory, gives tables and charts showing zeolite capacities together with sample computations on amounts needed, and details each portion of a softening system. Write Lakeside Engineering Corp., Dept. PW, 222 W. Adams St., Chicago 2, Ill.

### Conkey Filters for Sewage Sludge Disposal

180. Development of Conkey sludge filters and applications to all types of sewage sludge are described in Bulletin 100. Tables show filter sizes, weights, and give average anticipated results. Write General American Transportation Corp., Process Equip. Div., 10 East 49th St., New York 17, N. Y.

### Book Tells How to Control Root Stoppages

182. Details on the proven use of copper sulfate to control root and fungous growths in sewers are contained in a brand-new book published by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y.

### Bulletin Describes Complete PH Instrumentation

183. An attractive 16-page bulletin, No. 430, issued by the Foxboro Co., Foxboro, Mass., describes and illustrates the equipment offered by that company for the measurement and control of pH. The theory which is applied in actual pH control instrumentation is explained in text and diagrams.

## SNOW FIGHTING

### For High-Speed Snow Removal

44. "Frink One-Way Sno-Plows" is a four-page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow, Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

### Thrifty Salt Spreader for Snow and Ice Control

173. Check the Tarco "Scotchman" for fast, thrifty salt application to icy roads. Stainless steel spreader has weather-proofed engine. Get all data from Tarrant Mfg. Co., Jumel St., Saratoga Springs, N. Y.

### Chemical Stops Salt Corrosion

174. A new chemical has been developed which, when mixed 1 pound to 100 pounds of salt, prevents any corrosion of automobiles by the salt. Harmless; colorless; odorless. Permits free use of salt for ice and snow control without complaint by drivers. Calgon, Inc., Pittsburgh, Pa.

### End Dangerous Ice Hazards

179. Ice prevention on highways, streets and airport runways with Sterling "Auger Action" rock salt is described in illustrated bulletin PW issued by International Salt Co., Inc., Scranton, Pa.

## SEWERAGE AND REFUSE

### How You Can Clean Sewers From Streets Easily and Inexpensively

23. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 8059 Venice Boulevard, Los Angeles 34, Calif.

### Sanivan Features Faster Refuse Loading, Greater Capacity

31. Compression loading plate on the Sicard Sanivan crushes ordinary loose garbage into ½ original space. For clear, cut-away views of this positive compression action and mechanical full discharge get the "Sanivan" bulletin. Write Sicard Industries, Inc., 2055 Bennett Ave., Montreal 4, Canada.

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### One-Unit and Two-Unit Vitrified Floor Systems

32. Metro one-unit and two-unit vitrified clay blocks for trickling filter floors are described in illustrated catalog. Includes construction drawings, pictures and complete specifications. Ask for your copy today. The Metropolitan Paving Brick Co., Canton, Ohio.

### New Unit Cleans Catch Basins in a Jiffy

34. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass.

### Design Details for Sludge Collectors

42. Booklet No. P.W. 1742 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, illustration pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

### Packaged Sewage Treatment— Just Right for Small Places

36. "Packaged" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

### How You Can Dispose Of Sewage Solids

54. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Dept. PW, Nichols Engineering and Research Corp., 70 Pine St., New York 5, N. Y.

### Sewage Plant & Storage Facilities

62. General information on estimating figures on Horton's method to store surplus gas produced in digester at sewage disposal plants supplied by Chicago Bridge & Iron Company, 2115 McCormick Bldg., Chicago 4, Ill. Hortonspheres are built in sizes up to 65 ft. diameter for pressures as high as 60 pounds per sq. in. for storage at sewage plants utilizing digester gas.

### Glazed Clay Blocks for Trickling Filter Underdrains

66. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

### Standard Forms for Concrete Pipe

67. Concrete pipe for sewerage, drainage and culvert projects can be produced quickly and uniformly with Quinn Standard concrete forms. Data on forms for 12" to 84" tongue and groove or bell end reinforced pipe from Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

### Engineering Facts About Transite Pipe

83. This compilation of Johns-Manville's "Engineering Facts" series presents concise, factual information about Transite's many economic and engineering advantages, and includes informative case histories plus dimensions and data for your files. Write Johns-Manville, Box 290, New York 16, N. Y., or use the handy coupon.

### Vitrified, Salt Glazed Filter Bed Block

86. An 8-page folder contains instructive design applications and detailed descriptions of Dickey underdrain tile for filter bed bottoms. Diagrams show how air passes up through blocks for filter ventilation. Issued by W. S. Dickey Clay Mfg. Co., 922 Walnut St., Kansas City 6, Mo.

### How Cities Can Do Complete Sewer Cleaning From Street

98. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Power machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

### Pumps Suitable For Every Purpose

100. Large size trash pumps, propeller pumps, angle-flow pumps—a type suitable for every service. A separate bulletin for each is furnished by Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.

### Underdrains—Hidden But Important Filter Components

113. For filter bottoms this firm makes "Armcore" vitrified salt glazed floor blocks which provide ducts occupying 50% of the floor cross-section and air openings aggregating over 24% of the floor area. Described in several leaflets and data sheets. Ayer-McCarel-Reagan Clay Co., Brazil, Ind.

### Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-B-13 gives details. Roots-Connorsville Blower Corp., 310 Poplar Ave., Connorsville, Ind.

### Attractive Glass Enclosures For Sludge Drying Beds

164. Complete design details on American-Moninger glass sludge-bed enclosures are included in bulletin GE-31 issued by the American-Moninger Greenhouse Mfg. Co., 1820 Flushing Ave., Brooklyn, N. Y. This 24-page bulletin also shows a number of typical installations and furnishes complete specifications on construction details.

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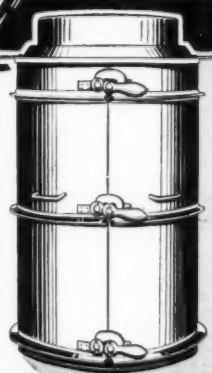
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For making pipe by hand methods by either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and larger—tongue and groove or bell end pipe at lowest cost.

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## How to Make Sewage Plant Grit Suitable for Fill, Roadways

**136.** The Jeffrey "Jigrit" washer does a thorough job of scrubbing grit free of organic solids. Grit is classified according to size and organics rejected with overflow. 44-page Catalog 775A describes the "Jigrit" and gives engineering data and installation views of grit and sludge collectors, chemical feeders, garbage grinders and other equipment as well. Dept. PW, Jeffrey Mfg. Co., 948 N. Fourth St., Columbus 16, Ohio.

## An Incinerator Necessity

**139.** Recuperators featuring silicon carbide heat transfer tubes and fireclay corebustors for maximum efficiency are described and illustrated in Bulletin 11 issued by Fitch Recuperator Co., Dept. PW, Plainfield Natl. Bank Bldg., Plainfield, N. J.

## Complete Sanitation and Process Equipment Bulletin

**181.** A complete, illustrated bulletin gives detailed information on all "Rex" sanitation and process equipment. 36 pages of engineering data, tables, conversion factors. Ask for Bulletin 48-41, Chain Belt Co., 1722 W. Bruce St., Milwaukee 4, Wisc.

## WATER WORKS

### What You Should Know About Hypochlorination

**20.** This really helpful booklet tells you a lot about hypochlorination of water for small and medium sized supplies, swimming pools and main sterilization, and fully describes the application of manual and automatic "Chem-O-Feeders" for constant or proportional feeding of chemicals. Send for Bulletin SAN-8 issued by Proportioners, Inc., 96 Coddling St., Providence 1, R. I.

### Makes Underground Pipe Installations Easy

**25.** One-man operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2050 Columbia Ave., Rockford, Ill.

### Is Your City Metered 100%?

**33.** 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

### Data on Modern, High-Rate Water Treatment Plant

**40.** This handsome 28-page bulletin gives a comprehensive yet understandably written story of the development of the Accelerator, and explains its principles, advantages, design considerations, operation and applications. Helpful flow diagrams and specifications. For a copy use the coupon or write Inflico Inc., 325 W. 25th Place, Chicago 16, Ill. Ask for Bulletin 1825.

### Solve Corrosion Problems With This Special Alloy

**41.** "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., the American Brass Co., 25 Broadway, N. Y. C.

### Eliminate Taste and Odor From Your Water

**53.** Technical pub. No. P.W. 213 issued by Wallace & Tiernan Co., Inc., Newark, 1, N. J., describes in detail taste and odor control of water with Break-Point Chlorination. Sent free to any operator requesting it.

### 88 Page Book Helps Solve Water Problems

**71.** pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 88 page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

## Improved Clarifiers with Carter Circular Motors

**61.** Latest Bulletin on water and sewage equipment, No. 4906, gives complete data and specifications on Carter's three different types of clarifiers. A valuable working guide for every sanitary engineer. Ralph B. Carter Co., Dept. PW, 192 Atlantic Ave., Hackensack, N. J.

## Helpful Data on Hydrants

**64.** Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

## Cast Iron Pipe and Fittings For Every Need

**65.** Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

## Recording Meters for Parabolic Flumes

**73.** Engineering data on parabolic flumes and accurate companion meters for open flow water and sewage metering is given in Simplex Bulletin 210. Installation data and calibration included. Write Simplex Valve and Meter Co., Dept. 4, 6750 Upland St., Philadelphia 42, Pa.

## Turbidity, Color and Hardness Removal

**77.** Modern water pre-treatment with Dorr equipment and methods is described in Bulletin No. 9141, which gives basic design data and flowsheets for pre-treating highly turbid water, color removal or treatment of low turbidity, and softening. Typical analyses for various types of waters are given together with detention times in recommended treatment units. Write The Dorr Co., Dept. PW, 570 Lexington Ave., New York 22, N. Y.

## Liquid Level Control

**78.** Description of operating principles and applications of B/W controls shows the simplicity and many uses of these all-electric, floatless devices. Diagrams of typical installations and engineering data all in Bulletin 147 issued by B/W Controller Corp., Dept. PW, Birmingham, Mich.

## Job Data Offered on New Steel Water Lines

**80.** A 12-page illustrated report listing pipe diameters, pipe wall thicknesses, line pressures, coatings, engineering personnel, etc., is entitled "A Report of Dresser-Coupled Steel Water Lines in the Year 1948." A copy will be sent by Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

## Speedier, Space-Saving Purification Apparatus

**81.** A new 12-page bulletin, No. 2204, tells how the Spaulding Precipitator, in removing impurities from a liquid by precipitation, adsorption, settling, and upward filtration, occupies less space, uses less chemicals and speeds up treatment. Permutit Co., 330 West 42nd St., New York 18, N. Y.

## Well Water Systems Built to Last

**105.** Layne pumps are built for wells ranging from 4" to 36" diameter and in capacities from 50 to 16,000 gpm. Full engineering data and many installation views are given in 32 page Pump Bulletin 4-42. Layne and Bowler, Inc., Memphis, Tenn.

## Pressure Pipe That Retains Capacity

**106.** Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., Box 269, East Orange, N. J.

## FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...



### SKINNER SEAL

Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed at bell face by Manel Metal Seal band—at spigot by hard vulcanized gasket lip.

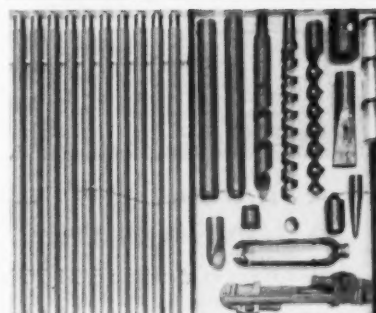
## AND BROKEN MAINS

### SKINNER SEAL

Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Manel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 16" incl.



M. B. SKINNER CO.  
SOUTH BEND 21, INDIANA, U.S.A.



## SOIL SAMPLING KIT

For Accurate, Dependable Subsoil Data

- 12 soil and earth sampling tools in handy steel box.
- Can be carried in any automobile.

30 years experience has proved these tools will recover accurate samples from practically all earth materials.

- MANY USES—brick and clay materials—foundation test borings—gold bearing sands—kaolin and clay for ceramics—sand and gravel pits—subgrade testing for highways and airfield runways—base materials.

• Send for Bulletin 26

ACKER DRILL CO., INC.  
SCRANTON 3, PA.

## Quality that Lives

**M**echanical equipment for water filtration that carries the Roberts Filter nameplate has long been recognized as equipment that gives lasting service. Installations thirty and more years old are still working "round the clock". However, even the finest equipment may need a replacement part occasionally, then you'll be glad you have Roberts Filter, for no part, however small, is an orphan after installation. Replacement parts can be supplied quickly, eliminating delays that are not only costly but often vital.

For water treatment equipment with quality that lives—specify Roberts Filter.

MECHANICAL EQUIPMENT  
BY  
ROBERTS FILTER MFG. CO.  
DARBY, PENNA.

**ROBERTS FILTER  
MANUFACTURING CO.**  
640 COLUMBIA AVE., DARBY, PA.



## Welcome to WASHINGTON, D.C.

Hotel Raleigh in the heart of official Washington is the headquarters for all tourists and business people. 400 Immaculate air-conditioned rooms, excellent cuisine, and the famous Paul Mall Room. Write today for our booklet or HONEYMOON brochure. Or see your travel agent. **SPECIAL COURTESIES TO HONEYMOONERS**

C. C. SCHIFFELER, VICE PRESIDENT  
AND MANAGING DIRECTOR



## WATER WORKS (cont.)

### How About Centrifugal Pumps?

**108.** Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage, single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Write to Dept. P.W., Peerless Pump Div., Food Machinery and Chemical Corp., 301 W. Ave. 26, Los Angeles 31, Calif.

### Specs for Gate Valves

**112.** Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 36"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

### Handy Catalog Describes Small Hydrants, Drinking Fountains

**115.** This 32-page catalog describes 3/4" to 2" hydrants. Also street washers, drinking fountains and other water service devices. The Murdock Mfg. & Supply Co., 426 Plum Street, Cincinnati 2, Ohio.

### Rust Wastes Your Money

**121.** You'll want data on the all-purpose anti-rust coating that can be brushed or sprayed on all metal surfaces, even those already attacked by rust. For full information on this firm, elastic coating write Rust-Oleum Corp., 2443 Oakton St., Evanston, Ill.

### Do You Ever Have Leaks to Fix?

**124.** You'll want to know about the full line of "Skinner-Seal" clamps for repairing bell and socket joint leaks and broken mains. Step-by-step procedures are illustrated in catalog 41, a handsome 40-page presentation which shows applications of all fittings. Write M. B. Skinner Co., Dept. PW, South Bend 21, Ind.

### The Modern Way to Filter Swimming Pool Water

**129.** That's the title of a bulletin full of facts about Bowers' new diatomite filter to produce clear, sparkling, clean water at low cost. Occupies small space, doesn't waste water. Gives sizes to use, performance charts, etc. Write Bowers, Inc., Dept. PW, 1395 Creighton Ave., Ft. Wayne, Ind.

### Data on Chlorinizer Now Available

**132.** Bulletin 840-F2 features the Builders Chlorinizer and shows complete details of apparatus to accurately meter chlorine gas and deliver controlled chlorine-water solution. Positive rate of flow indication, wide metering range. Get your copy of this bulletin from Builders-Providence, Inc., 16 Coddling St., Providence 1, R. I.

### All About Cement-Mortar Lining of Water Mains

**133.** Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centrlime Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

### Faster Pipe Laying With Precaulked and Threaded Joints

**148.** McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

### "Tailor-Made" Pumps Fit Your Requirements

**156.** Application-Engineered vertical turbine pumps to suit your particular pumping requirements are completely described in Bulletin P-178. Details of optional driving and pumping arrangements clearly illustrated. Get your copy from A. O. Smith Corporation, Dept. PW, Milwaukee 1, Wis.

## POWER AND LIGHT

### Dual Fuel Engines for Municipal Power

**27.** A new 8-page illustrated bulletin, No. 4811, describes Superior Dual Fuel Diesel engine operation and illustrates the simplicity of controls with fuel conversion by either push buttons or hand lever. Copies are available from Superior Engine Div., Dept. PW, The National Supply Co., Springfield, Ohio.

### Low Cost Power From Dual Fuel Engines

**154.** Operating on the Diesel cycle, burning either oil or gas, the Worthington Supercharged Dual Fuel Diesels give high economies by running on the cheapest fuel available. Get complete data from Worthington Pump & Machinery Corp., Dept. PW, Harrison, N. J.

## CONSTRUCTION EQUIPMENT

### Data Book on Universal Concrete Cribbing

**21.** Shows typical sections for designing walls, pictures many applications, specifications, etc. Get the facts today about this economical reinforced concrete cribbing. Universal Concrete Pipe Co., Dept. PW, 297 So. High St., Columbus 15, Ohio.

### Solve Your Drainage Problems This Easy, Permanent Way

**28.** Useful new 60 page catalog on standard corrugated pipe, multi-plate pipe and arches and 18 other drainage and related products for culverts, sewers, sub-drains, flood control, airports, water supply and other types of construction. Ask for "Armco Products for Engineering Construction," Armco Drainage and Metal Products, Inc., Dept. PW, Middletown, Ohio.

### Methods of Installing Steel Sheet Piling

**30.** Illustrated descriptions of both standard and interlock corrugated steel sheet piling of minimum weight, maximum strength, ease of handling with methods of installation are contained in a booklet. If you have a job involving piling write Caine Steel Co., Dept. PW, 1820 No. Central Ave., Chicago 30, Ill.

### Shovel or Load With The Dempster Diggster

**45.** Automotive Hydra-Shovel digs 15 ft. above, 15 in. below grade, features independent hydraulic hoist and crowd action. Capacities 1 cu. yd. for digging solid earth, 1 1/4, 1 1/2 and 2 cu. yd. for loading all types material. Get information from Dempster Brothers, Inc., 949 Dempster Bldg., Knoxville 17, Tenn.

### How to Keep Your Loader On the Job

**50.** Don't take more time to move your loader to the job than to do the work. Investigate the Eagle Truck Mounted Loader for handling gravel, sand, cinders, snow from windrows or piles. Get forms 444 and 947 from Eagle Crusher Co., Inc., Galion, Ohio.

### The Right Compressor For Every Job

**74.** This 32-page catalog lists a full line of compressors built in the sizes needed to operate efficiently modern air tools. Write for Catalog JC-8. Jaeger Machine Co., Columbus 16, Ohio.

### Keep That Trench Pumped Really Dry!

**93.** To find out how well a Homelite Carryable Pump handles large volumes, seepage, mud, write today for illustrated bulletin L-503 containing data of great value to all pump users. Write Dept. PW, Homelite Corp., 2110 Riverdale Ave., Fort Chester, N. Y.

### Special Pumps to Fit Any Dewatering Job

**101.** Centrifugal Pumps. Long lasting, self-priming, non-clogging pumps for quickly dewatering trenches and similar

construction jobs. Ask for Bulletin 7-LW-13. Gorman-Rupp Co., 320 No. Bowman St., Mansfield, Ohio.

#### The Right Tractor For Your Job

116. Whether you need a front-end loader, snow plow, bulldozer, sweeper or mower, International wheel tractors combine correctly with allied equipment to do the job. Your choice of gasoline or diesel units is illustrated in Bulletin A-103JJ. International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

#### International Trucks Are Built to Take It

120. Trucks take a pounding in construction work—that's why you need data on International Trucks that are engineered for your job. Check the coupon or write International Trucks, Dept. PW, 180 N. Michigan Ave., Chicago 1, Ill.

#### Air Cooled Engines for Hundreds of Applications

137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

### STREETS AND HIGHWAYS

#### Strong, Speedy, Low-Cost Maintainer Has Many Uses

22. BG Machine, a powerful speedy, low-priced machine for light road maintenance. Full details in illustrated folder. Huber Mfg. Co., Dept. PW., Marion, Ohio.

#### Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 10, Wis.

#### Latest Maintenance Equipment For Blacktop Roads

52. "Blacktop Road Maintenance and Construction Equipment"—Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

#### Power Saw Speeds Pruning, Clearing

69. Don't wait until storms have broken limbs and felled trees before finding out about the new light-weight engine powered chain saw announced by McCulloch. Ideal for all contracting and tree-maintenance operations. Get bulletin from McCulloch Motors Corp., Dept. MP, 6101 W. Century Blvd., Los Angeles 45, Calif.

#### Fast, Efficient Skid-Proofing

114. Get full facts about Baughman Light-Weight Cinder Spreaders, fast operators for cinders, sand, salt, chips, etc. Free flowing at low temperatures. 9-17 cu. yd. capacity. Write Baughman Mfg. Co., 1101 Shipman Road, Jerseyville, Ill.

#### How to Speed Curb and Gutter Work

126. Here's a 24-page bulletin illustrating form set-ups for every type of curb and gutter work. Send for Bulletin 2259 and learn how to speed up the job with Blaw-Knox Steel Street Forms. Write Blaw-Knox, Dept. PW, Farmers Bank Bldg., Pittsburgh 22, Pa.

#### Modern Sweeper Speeds Street Cleaning

162. The Austin-Western Model 40 sweeper features three wheel design, front wheel steer, for easy maneuvering; rear broom to sweep dirt and refuse directly into 2-yd. hopper; built-in flushing device. Diagrams showing all operations and full specifications in Bulletin AD-2042, issued by Austin-Western Co., Aurora, Ill.

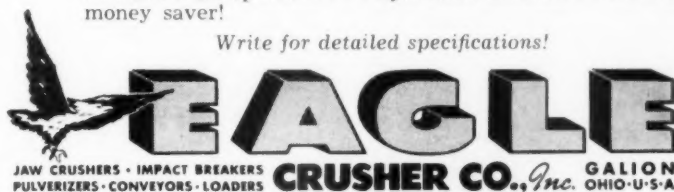
# ACTION... lots of it!



## ...with this EAGLE LOADER

Loads 3 to 5 yards per minute of any loose dirt, cinders, gravel, snow, etc. Gets from job to job at highway speeds . . . one man operated . . . hydraulic controls . . . It's a money saver!

Write for detailed specifications!



## For BARE-DRY-SAFE Winter-time Pavements



Use clear chemicals applied with a *THRIFTY* "Scotchman." Clear salt—through a stainless steel "Scotchman"—is spread seven times faster, and 50% cheaper than sand or cinders. The "Scotchman's" thin, wide, "bird-shot" salt pattern prevents anchor-ice; insures fast, clean plowing without excessive brine to cause damage.

You should see this amazing spreader which saves hundreds of users up to \$4.25 every mile treated.

**COMPLETE CONTROL:** direction, width, and rate of spread  
**WEATHER-PROOFED ENGINE** • **ELECTRIC STARTER**  
**BAGGED or BULK SALT** • **USE on ANY TRUCK or PICK-UP**

LITERATURE? DEMONSTRATION?

**TARRANT MFG. CO.**

JUMEL ST., SARATOGA SPRINGS, N. Y.

## WHO BUT YOU?

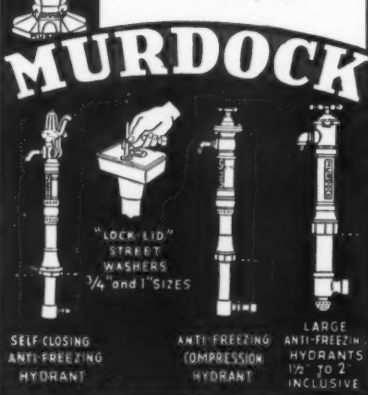
Who but you, Mr. Reader, should raise his voice in behalf of the people in regard to the installation of outdoor drinking fountains.

Put the water with which this land is blessed within the mouth reach of your fellow-citizens in spots like transfer points, downtown corners, playgrounds, etc.

Try it at a few points and see what happens.

"It Pays to Buy MURDOCK"

The Murdock Mfg.  
& Supply Co.  
Cincinnati 2, Ohio



## Chlorine DETERMINATIONS

—easy for everyone with



## TAYLOR-ENSLow SLIDE CHLORIMETER

... No special training necessary. The accuracy, compactness, durability and portability of the Taylor-Enslo Slide chlorimeter makes it ideally suited to on-the-spot determinations of the free or residual chlorine content of water, sewage and industrial wastes.

Taylor-Enslo slides are molded of plastic ... contain a complete set of 9 liquid color standards, all of which carry an unlimited guarantee against fading. Two slides are available: 0.0 to 1.0 p.p.m. and 0.0 to 3.0 p.p.m. of chlorine. Combination pH and Chlorine sets, and complete Taylor Water Analyzers are also available.

### READ THIS VALUABLE BOOK—FREE



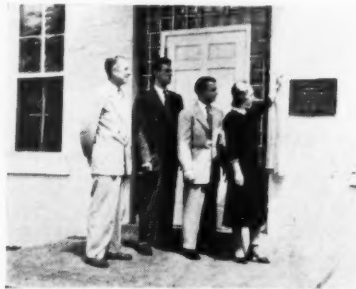
96 pages of authoritative general information for water and sewage engineers as well as describing Taylor sets. Write for your copy today—see your dealer for equipment.

**W. A. TAYLOR** AND CO.  
7304 YORK RD. • BALTIMORE-4, MD.

## WORTH TELLING . . . . By Arthur K. Akers

**Graver Water Conditioning Co.** has removed to New York, opening offices at 216 West 14th Street, in charge of **Henry Sulzer**. This company is a division of Graver Tank & Mfg. Co. of Chicago.

Pictured below is a dedication scene before the new research laboratory of the **Atlas Mineral Products Company** at Mertztown, Pa.

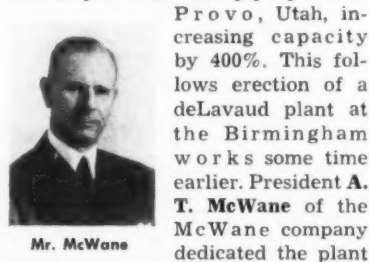


Left to right, **George L. Wirtz**, son of the founder of the company, **Maximilian F. Wirtz**; **Arthur F. Wirtz, Jr.** and **George L. Wirtz, Jr.**, his grandsons; and **Mrs. Bernardine Wirtz Dorr**, widow of the founder.

Now there is a brick-laying machine! A premier demonstration was held in Montgomery, Ala., Sept. 29th. Unlike the old system of brick laying this one seems to include no union, no restriction of output, no strikes, and no noncontributory pension system. We predict a great future for it.

**Builders-Providence** and **Omega Machine Co.** have moved their Chicago office out to 1141-43 Greenleaf Avenue, Wilmette, Ill.

**Pacific States Cast Iron Pipe Co.** affiliate of **McWane Cast Iron Pipe Company**, Birmingham, has dedicated and put into operation a brand new Super deLavaud pipe plant at



Mr. McWane

Provo, Utah, increasing capacity by 400%. This follows erection of a deLavaud plant at the Birmingham works some time earlier. President **A. T. McWane** of the McWane company dedicated the plant

respect and affection, a pioneer whose work still goes on.

**Croxtan Morris**, vice president of **PUBLIC WORKS**, is nominee for Trustee of the National Council for Community Improvement, with election to be held at the annual meeting in Philadelphia October 11-12. He seems as confident as a Democrat running for local office in Mississippi.

Dropping in on **Harold M. Messenger**, manager of sales engineering for the **American-LaFrance International** parking meters in Elmira, N. Y., the other day, to sell him a few pages of advertising, we all but bought a couple of parking meters for our personal use instead. They really have a municipal money and space saver in them.

**James F. McTeague** is the new assistant sales manager of an old friend, **The Buffalo-Springfield Roller Co.** of Springfield, Ohio. Mr. McTeague will work with the firm's distributors with a view to having still more counties and cities "roll their own."



Mr. McTeague



Mr. Twist

**Gerald F. Twist** is the new manager of Food Machinery and Chemical Corporation's **Peerless Pump Division**, in Los Angeles.

**Wm. W. Hopwood** has been elected vice president of the **Hagan Corporation**, Pittsburgh, and its subsidiaries.

**T. E. Woodruff** is announced by **Fairbanks, Morse & Co.** as assistant manager of the pump sales division, with headquarters in Chicago. He moves up from manager of their St. Louis pump branch.

Sorry this column is too narrow for a picture so wide as that of the 145 surprise fiftieth birthday cakes **The Thew Shovel Company** sent to Thew-Lorain distributors in 125 cities.